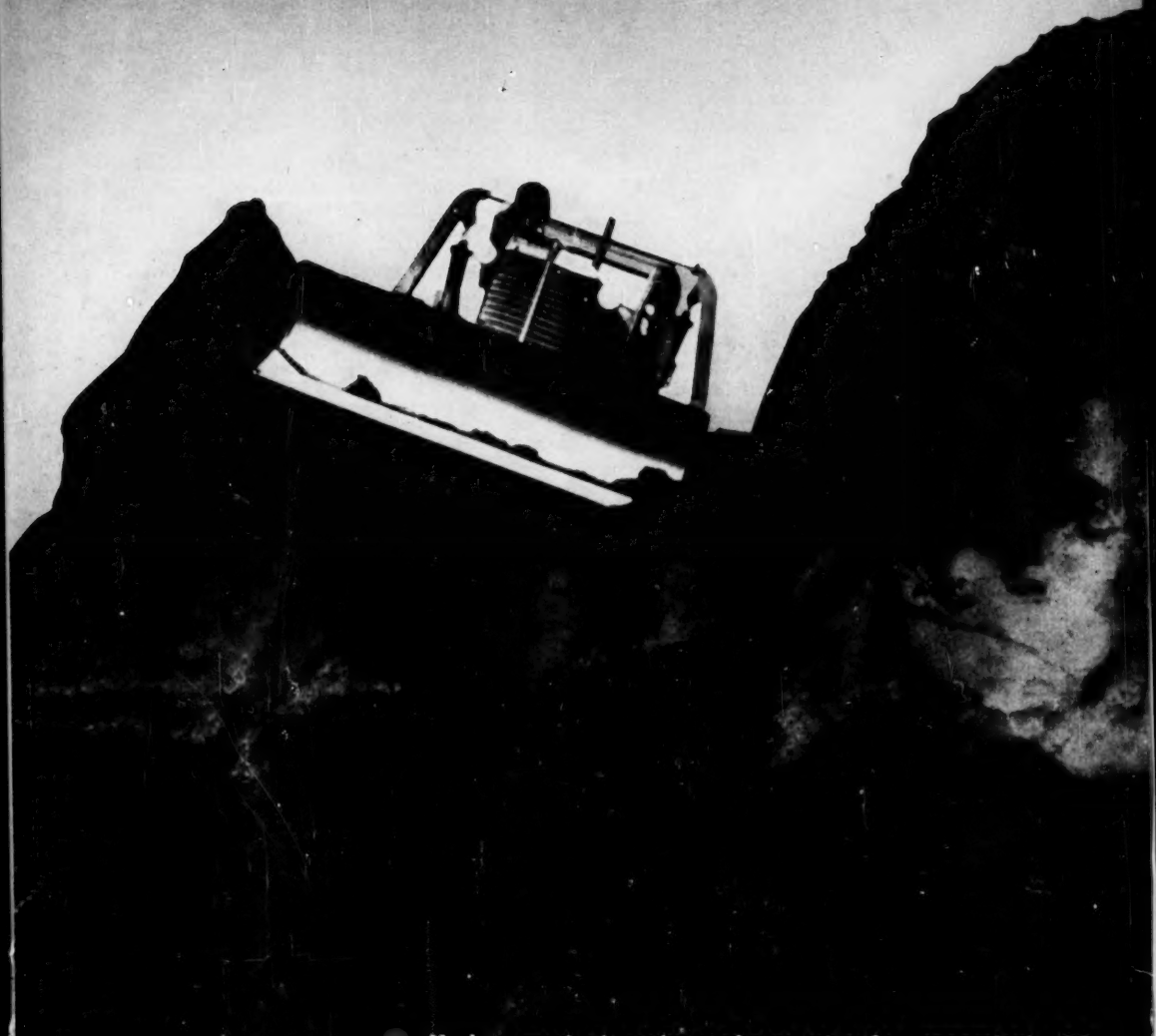
GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

Power

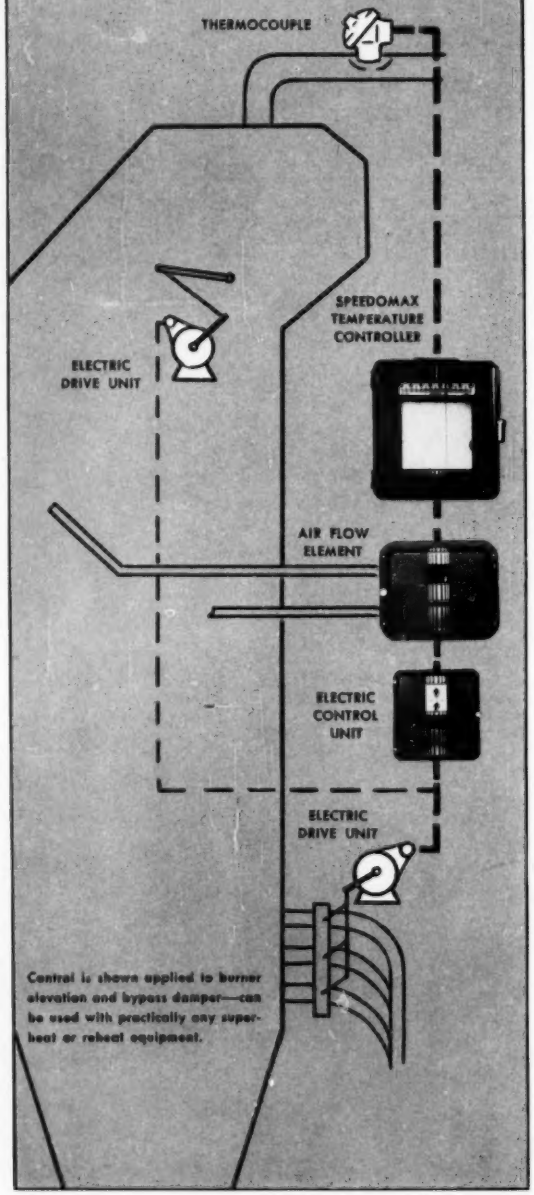
January
1952 • 50¢

A McGRAW-HILL PUBLICATION



Modern methods make coal storage safe, economical — 82

4 Reasons for uniform temperature with L&N superheat and reheat control


THERMOCOUPLE
SPEEDOMAX TEMPERATURE CONTROLLER
ELECTRIC DRIVE UNIT
AIR FLOW ELEMENT
ELECTRIC CONTROL UNIT
ELECTRIC DRIVE UNIT
Control is shown applied to burner elevation and bypass damper—can be used with practically any superheat or reheat equipment.

1. HIGH SPEED THERMOCOUPLE responds 3 times as fast as usual detectors for steam header installation. Metal-to-metal contact between couple and its protecting tube speeds heat transfer from steam to the low-mass detecting element. The whole assembly is rugged, stable, withstands vibration, is easily mounted in high-pressure piping.

2. SPEEDOMAX TEMPERATURE CONTROLLER embodies years of L&N know-how in temperature measurement and control. Accurate and sensitive, it operates through its control system to hold superheat at the top safe limit, no matter how boiler load varies. Built into the instrument are features which hundreds of successful installations have proved desirable for superheat control—such as high temperature alarms, provision for safety runback of controlled elements in the event of excess temperature, and thermocouple fail-safe circuit.

3. TWO ELEMENT CONTROL anticipates temperature changes even before they reach the thermocouple. Air Flow Element causes primary movement of dampers, etc., as soon as boiler load varies. Speedomax Controller and its associated Electric Control Unit follow with final adjustment based on actual steam temperature.

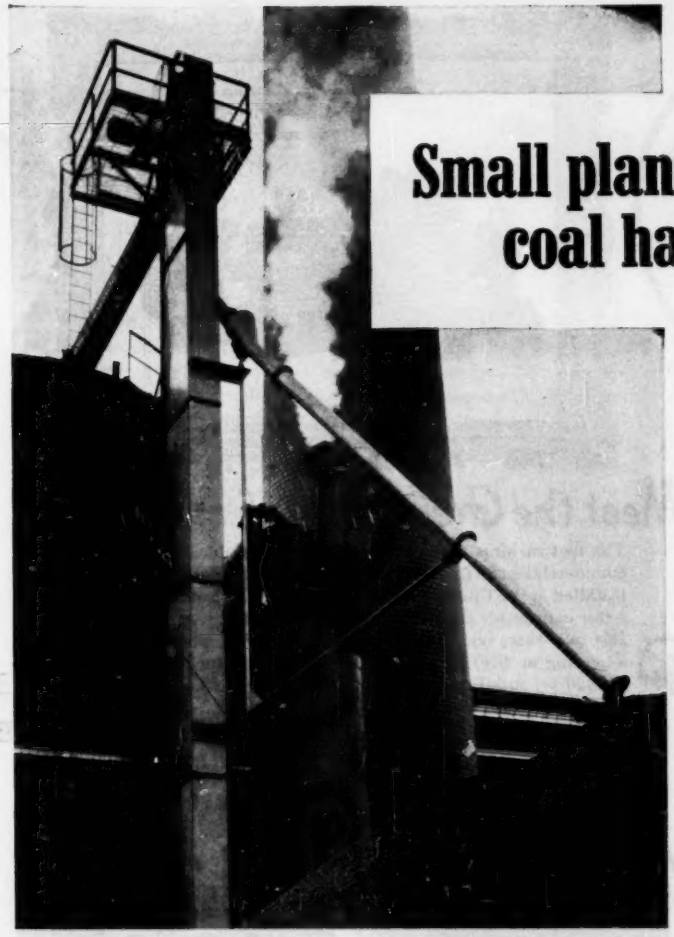
4. ELECTRIC DRIVE UNITS, powerful and reliable, move all controlled elements. High starting torque moves heavy friction loads smoothly and continuously. Worm gear train makes back-driving impossible. Dampers, valves, burners, etc., can be moved readily by hand-wheels in event of power failure. Control lines are electrical wiring, impossible to freeze or clog.

Our engineers will be glad to work with you on superheat or reheat control problems which you may be planning. Write to Leeds & Northrup Co., 4910 Stenton Avenue, Philadelphia 44, Pa.

Ind Ad ND44-33A-463(3)

LEEDS NORTHRUP

Small plants, too, slash coal handling costs



LINK-BELT engineering and equipment provide "big-plant" efficiency

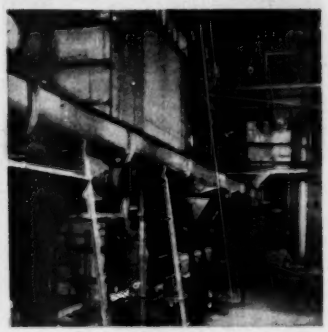
Whether you handle one ton or 2000 tons of coal per hour, Link-Belt builds equipment to match your requirements. As in the power plant shown here, Link-Belt offers you all the latest advances in coal handling equipment.

Our engineers will work with you and your engineers from design stage to finished structure, selecting the proper equipment for your plant. Result: lower cost per ton handled.

Link-Belt coal handling equipment at this plant delivers coal from railroad car to storage to boiler. L-B Bucket Elevator discharges to silo and also handles coal to and from reserve ground storage.

Bar Flight Feeder handles coal from track hopper to bucket elevator at capacity rate of 50 tons per hour. Link-Belt Gearmotor and Roller Chain comprise the drive.

Bulk-Flo, a combined feeder-conveyor-elevator, reclaims coal at 10 TPH from live storage to surge hopper. Only the horizontal section of L-shaped path is shown.



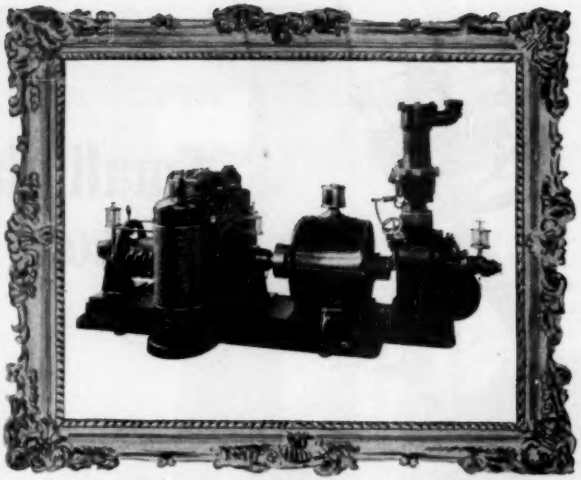
Coal flows from Bulk-Flo to surge hopper, then through automatic weigh scale to a Link-Belt Screw Conveyor, which distributes to three stoker hoppers.

COAL HANDLING EQUIPMENT

LINK-BELT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12,807

De Laval Turbines at work!

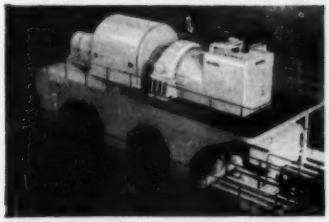


Meet the Grandaddy of all Turbines

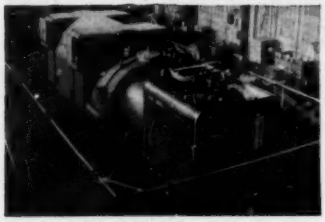
The first turbine-driven generating set to produce current on a commercial scale in the United States was this De Laval unit installed at the Chicago World's Fair in 1893. Grandad was a fast man in his day too . . . he delivered 10 hp at 24,000 rpm. Just four years later, four De Laval 100 hp turbine generators operating at 2840 psi, 750° F and two 50 hp turbines operating at 1420 psi supplied all the power for the Stockholm Exhibition. That is high pressure, high temperature operation even by today's standards!

Next time you're in our neighborhood stop in and see Grandad. He is on display in our reception room. Then let us take you through our shops . . . there you'll see how the finest turbines in the country are built.

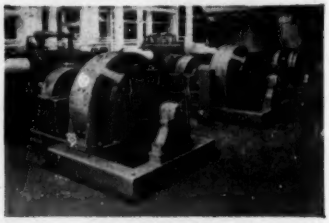
and here are a few of his Grandsons—



7500 KW De Laval turbine generator installed in the municipal power plant of the city of Lubbock, Texas. The 15 stage turbine is designed for 600 psi, 825° FTT.



This 11,500 KW De Laval turbine generator and another just like it will soon be supplying power for one of our key Naval bases.



Power for a New England textile mill is generated by these three 1000 KW De Laval geared turbine generators.

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

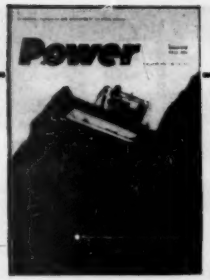
DL 122

50th DE LAVAL Anniversary

Power

JANUARY 1952 VOLUME 96 NO. 1

combined with Operating ENGINEER



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COAL STORAGE, our cover picture reminds us, is big business these days. Thus far, there's no need to worry about production, but the transportation situation is tight, may well get tighter. It's just good sense to buy in the slack periods, stockpile for the peaks.

There was a time when such stockpiling was expensive and risky. But modern methods of handling coal into storage and building the pile (see p 82) cut costs. Perhaps even more important, they reduce the possibilities of spontaneous combustion, keep the coal from deteriorating markedly even if stored for long periods.

Next month . . .

■ If you think you can do heat-balance tricks with double-automatic-extraction turbines, wait until you see what the new *triple*-extraction condensing units offer. J M Baker and E V Pollard of GE's Lynn Works tell you how these machines work, how to apply them in your plant.

■ Going to buy an air-compressor? Getting the right one for your job isn't as easy as it sounds, so you'll welcome the practical pointers on selection given in a February article.

■ Locomotives leave the CPR freight terminal near Montreal on steam supplied from a new boiler plant. No more clouds of smoke over city areas from freshly started fires—and a new job for the power engineer.

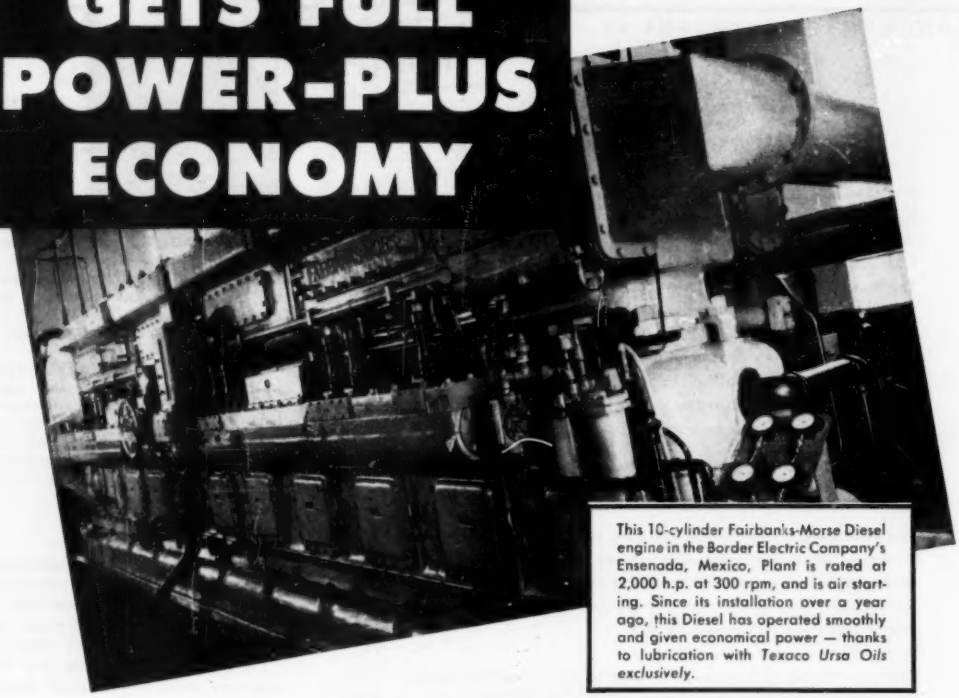
■ Mention engineers' license laws in any group of operating men and you'll have a hot argument in no time. Take L D Young's February discussion of the basis for a good law to the next meeting of your operating-engineer group and see if we're right.

. . . *and future months*

■ The fight against corrosion is a full-time one for power engineers. Future articles bring you latest communiques from two fronts—turbine blading and condenser tubes.

■ Modern Plant Survey, scheduled for March, brings you technical data on the hundreds of new plants being built to power the defense effort.

GETS FULL POWER-PLUS ECONOMY



This 10-cylinder Fairbanks-Morse Diesel engine in the Border Electric Company's Ensenada, Mexico, Plant is rated at 2,000 h.p. at 300 rpm, and is air starting. Since its installation over a year ago, this Diesel has operated smoothly and given economical power — thanks to lubrication with *Texaco Ursa Oils exclusively.*

...with the help of TEXACO URSA OILS

As in the plant illustrated, operators of Diesel, gas, and dual-fuel engines everywhere are getting full power and low maintenance costs with the help of *Texaco Ursa Oils*. These oils reduce fuel consumption because they keep rings free, ports open, and valves functioning properly — assuring better compression and combustion.

Texaco Ursa Oils are world-famous for their ability to resist oxidation and sludging, to stand up under heat and pressure, and keep engines clean for trouble-free performance. You get longer service life from bearings and all moving parts . . . increased efficiency and reduced maintenance costs.

Texaco Ursa Oils are available in every needed viscosity. Approved by leading engine manufacturers and recommended by users from coast to coast, they are easily America's favorite. In the Diesel field alone:

For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

A Texaco Lubrication Engineer will gladly show you how *Texaco Ursa Oils* will reduce costs in your operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO URSA OILS
FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Faithfully yours 50 *for Fifty Years*

TUNE IN... TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

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...with Power readers...

MORE ON "DIMETRICS" . . .

Several of the boys in the power plant of the above hospital [Rockland State Hospital] have been taking a course in basic power-plant sketching in connection with studies in stationary engineering.

Having seen the article on the "Bylines" page of the November issue in regard to "dimetrics," we have become interested in this new phase of drawing. We would like to see more on this subject.

Orangeburg, N. Y. LEWIS C VAN HUBEN

Old-friend Van Huben's request for an article on dimetrics is typical of many received from all parts of the country. So you may count on an article in the near future. Actually, we plan to tackle the whole subject of *trimetrics*, of which dimetrics is a special (and very useful!) case.

Not a few of our correspondents caught us in a typographical error: the page reference for the article in which dimetrics was used was 83, not 86 as we said. For a really good lineup of drawings done by dimetrics, see p 72 of the December issue (and this time we *mean* p 72).—*Ed.*

COLOR CODING PIPING . . .

Can you suggest to us the name of the publisher of any existing standards govern-

(Continued on page 222)

...lines and bylines

IF WATER were only H_2O and nothing else, life would be much simpler for power engineers. Best testimony to the problems attached to using this apparently innocuous fluid is continued interest of POWER readers in articles on water conditioning by experts like Paul Brindisi (p 80).

Paul Brindisi

Paul graduated in chemical engineering from Villanova ('36), did graduate work in analytical chemistry of alloys at University of Pennsylvania. After a short spell of checking coal quality for Philadelphia's Board of Education, he moved over to Fischer & Porter Co. designing and specifying materials for flowmeters and accessories.

He first tangled directly with water and its idiosyncrasies as a member of the technical department and trouble shooter for W H & L D Betz. In February 1946, Paul founded Celco Laboratories, where he still wrestles with water problems. Days off, he cartoons (you've seen some in POWER), officiates scholastic sports.

SAFETY WARNINGS, like those against sin, all too often fall on deaf ears. But when a man like Bill Davis sounds off on plant hazards, engineers listen, because Bill knows the score.

W N Davis

A graduate of Massachusetts State Maritime Academy (1926), Bill learned his engineering as so many top-notch power men have—in ships' engine rooms. After six years of this and three in shore plants, he went with Zurich Insurance Co. In 12 yr as safety engineer and asst to the chief, he supervised inspections and specialized in power-plant and industrial casualty insurance.

For the past two years Bill has been senior safety engineer for the National Safety Council. Out of his concentrated experience on pressure vessels, welding, refrigeration, heavy-metal fabrication and materials handling, he's distilled many practical tips for power men (like those on p 103).

NEW STAFFERS, whose work you'll be seeing in the "more" POWER, are Althea Schaffer and Jim Kohler.

Althea Schaffer

"Al" took her mechanical engineering degree at Penn State, found time to be co-editor of *Penn State Engineer*. Jobs since include some turbine engineering (very "junior" she says) and production. On POWER, Al handles News and New Bulletins, aims for more Reader Service responsibilities.

C J Kohler

Jim's education began at Phillips Andover, was interrupted by a spot of army life. He got to be a platoon sergeant, no less, and taught basic training at Camp Lee. When Uncle Sam let go, Jim went back on the receiving end, majored in ceramic engineering at University of Texas. Right now, he's learning to be a good right-hand to Executive Editor Lou Rowley.

now

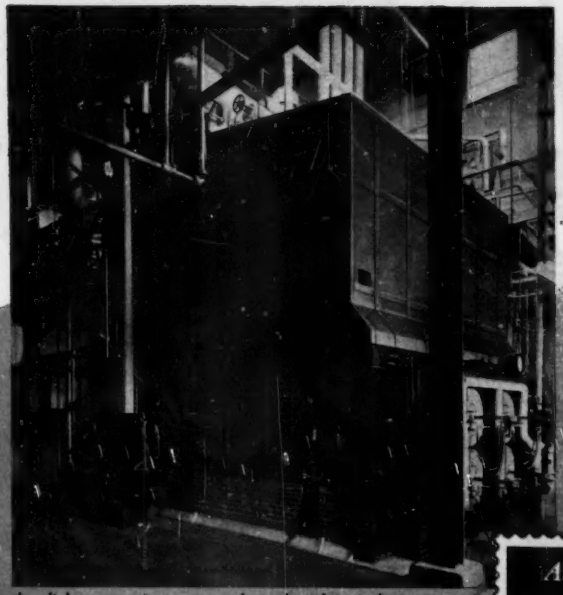
an integral-furnace boiler
for 30,000–70,000 lb. steam per hr.

TYPE FJ SAVES:

- fuel
- maintenance
- space

Integral-Furnace Boiler, Type FJ, arranged for stoker firing.

BABCOCK & WILCOX



This oil fired unit in an eastern processing plant is rated at 55,000 lb. steam per hr. . . . readily carries highly variable load without fluctuation of pressure.

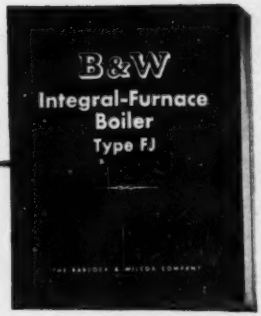
Another Example of B&W Engineering for Economy

The Integral-Furnace Boiler, Type FJ is a recent addition to B&W's line of completely coordinated furnace-boiler steam-generators. It makes available a compact, highly efficient installation to answer all process, heating, or power requirements from 30,000 to 70,000 lb. per hr.

Complete fuel-flexibility — coal, oil, or gas, with a choice of alternative firing arrangements — protects the investor against radical changes in fuel prices or conditions of supply. This unit burns a wide variety of fuels — including those of inferior grades and low-temperature ash-fusion characteristics — with high heat-rate efficiency, low maintenance, and minimum stack emission.

Unusually wide leeway in water-level and allowable boiler-water concentration is provided by the large drum and efficient cyclone steam separation system . . . which also contribute to ease in meeting sudden and severe load swings.

This unit incorporates all the advantages of Integral-Furnace design, which has proved so successful since its introduction by B&W in 1933. The popular Integral-Furnace "Family" now includes Types FH, FL, FJ, FF, and Shop-Assembled FM Units—spanning a range of steam-capacity now available from 2,800 to 350,000 lb. per hr.



Complete details of construction and operating advantages of the Integral-Furnace Boiler, Type FJ are included in new Bulletin G-70, available upon request from the Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

G542T

DIAMOND
SOOT BLOWERS

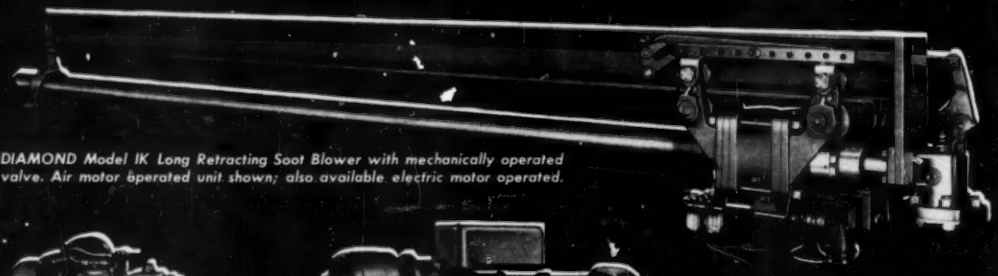
Meet the challenge of HIGH BOILER AVAILABILITY

The greater emphasis being placed on high boiler availability indicates the equal importance of high soot blower availability. The first can be limited by the second.

No other power plant equipment takes the "beating" to which soot blowers are daily subjected. Elements are exposed to repeated, sudden and severe thermal shock . . . to extremes of temperature, erosion and corrosion.

Diamond has long paid particular attention to "high availability" in its research . . . in the design, in the selection of materials and in the manufacture of all Diamond Soot Blowers. That they excel in this direction also is attested by their performance records . . . and by the preference they have long enjoyed among the most critical users of boiler equipment. The next time you need soot blowers, it will pay you well to select Diamond Soot Blowers.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario



DIAMOND Model IK Long Retracting Soot Blower with mechanically operated valve. Air motor operated unit shown; also available electric motor operated.

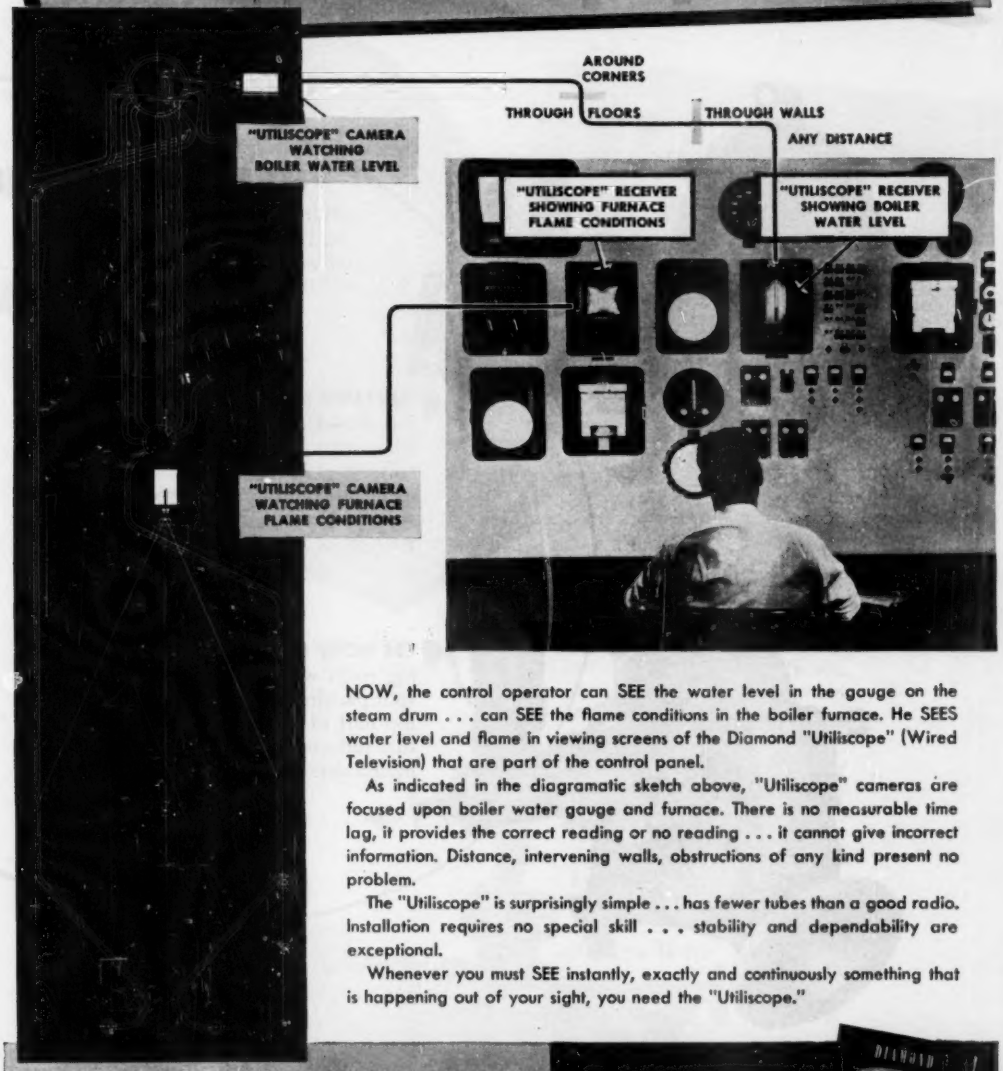
DIAMOND Model G9B Soot Blower. Air operation shown; also available for manual or electric operation.

DIAMOND Model IR Short Retracting Soot Blower. Electric operation shown; also available for manual or air operation.

DIAMOND Model A2E Automatic Air Puff Soot Blower.

There is a DIAMOND Soot Blower . . . for Every Boiler Cleaning Requirement

The "UTILISCOPE" (WIRED TELEVISION) Brings REALISM to Centralized Control


AROUND CORNERS
THROUGH FLOORS
THROUGH WALLS
ANY DISTANCE
"UTILISCOPE" CAMERA WATCHING BOILER WATER LEVEL
"UTILISCOPE" RECEIVER SHOWING FURNACE FLAME CONDITIONS
"UTILISCOPE" RECEIVER SHOWING BOILER WATER LEVEL
"UTILISCOPE" CAMERA WATCHING FURNACE FLAME CONDITIONS

NOW, the control operator can SEE the water level in the gauge on the steam drum . . . can SEE the flame conditions in the boiler furnace. He SEES water level and flame in viewing screens of the Diamond "Utiliscope" (Wired Television) that are part of the control panel.

As indicated in the diagramatic sketch above, "Utiliscope" cameras are focused upon boiler water gauge and furnace. There is no measurable time lag, it provides the correct reading or no reading . . . it cannot give incorrect information. Distance, intervening walls, obstructions of any kind present no problem.

The "Utiliscope" is surprisingly simple . . . has fewer tubes than a good radio. Installation requires no special skill . . . stability and dependability are exceptional.

Whenever you must SEE instantly, exactly and continuously something that is happening out of your sight, you need the "Utiliscope."

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO

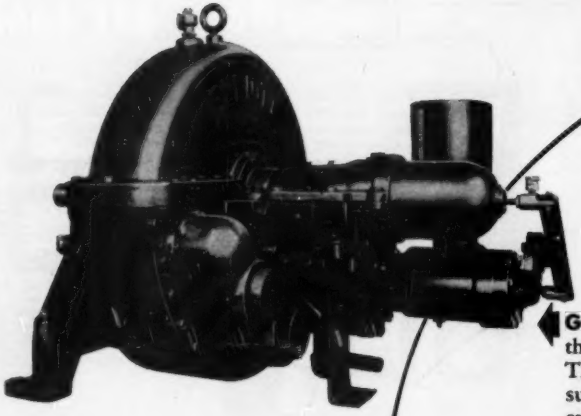
The "UTILISCOPE"—First in Industrial Television

Diamond Specialty Limited — Windsor, Ontario

WRITE FOR
BULLETIN 1025

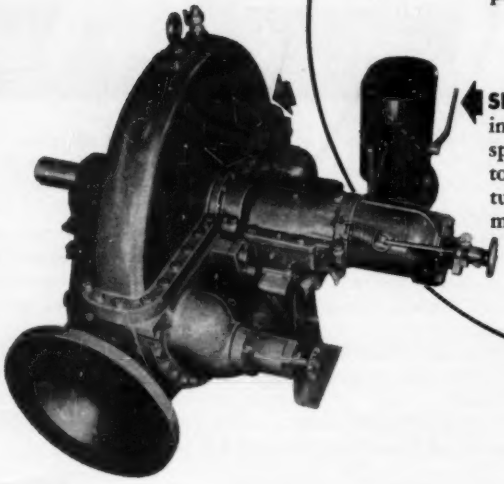
with complete description; it suggests many other possible uses.

ANY WAY YOU LOOK AT IT....



HERE IT IS all insulated and lagged and ready for business. Makes a neat package of rugged "driveability", doesn't it? But let's take the dressing off...

GETTING DOWN TO THE BARE FACTS this shows the clean lines of the turbine. The steam inlet can be supplied in size suitable to the application, and the liberal exhaust connection provided on either side, as desired. Makes application simpler. Now take a bird's-eye view . . .



SEE HOW EASY IT IS to get at the packing rings with the separate horizontally split packing cases, without removing the top half of the turbine casing. This feature reduces the time required for normal maintenance.

Now look inside . . .

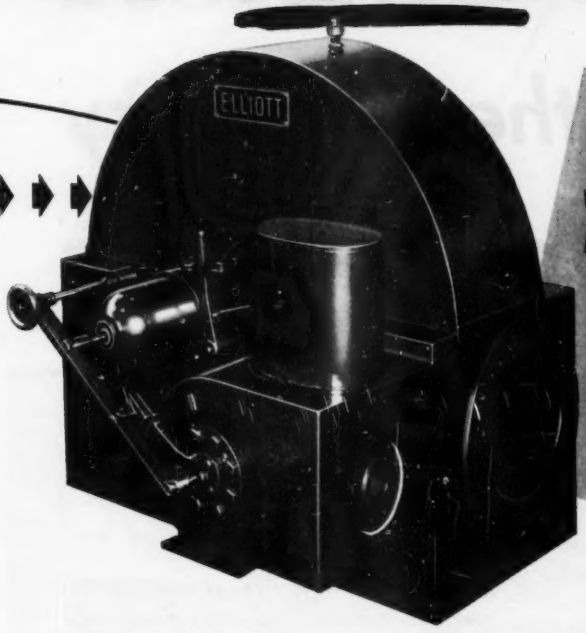
ELLIOTT Company

Steam Turbine Dept. • Jeannette, Pa.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

it's some turbine!



ELLIOTT YR Turbine

...can be modified to almost tailor-made adaptability to specific operating conditions

NOW YOU CAN SEE the airwall labyrinth bearing seal . . . The liner type horizontally-split main bearing . . . The dynamically balanced rotor, with stainless steel buckets and shroud . . . The ball thrust bearing which accurately locates the rotor . . . The simple, rugged mechanical shaft governor.

But all this is just part of the picture. True centerline support is a major factor, insuring unchanging alignment between turbine and driven unit, in spite of temperature change. Remember too the many modifications in controls and other features, all available without departure from standardization. Here's a mechanical drive turbine that is typical of the best in Elliott engineering. Why not 'phone your nearest Elliott office . . . . . or write us for Bulletin H-16?

H-737

How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

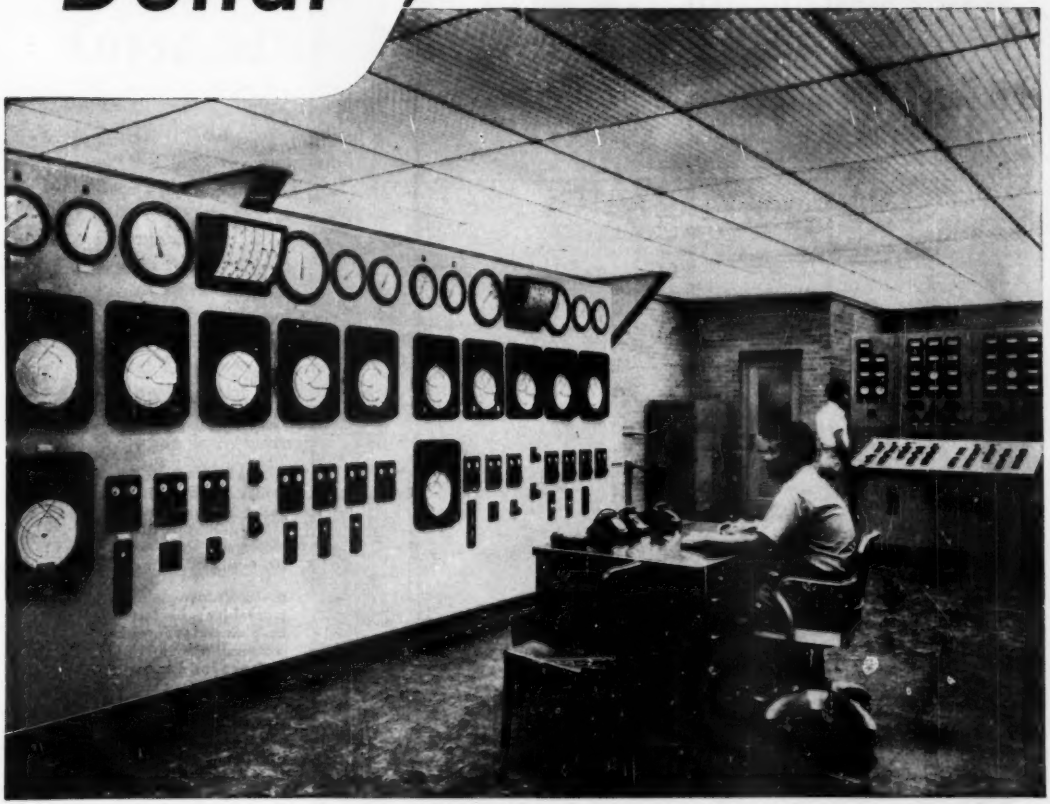
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar



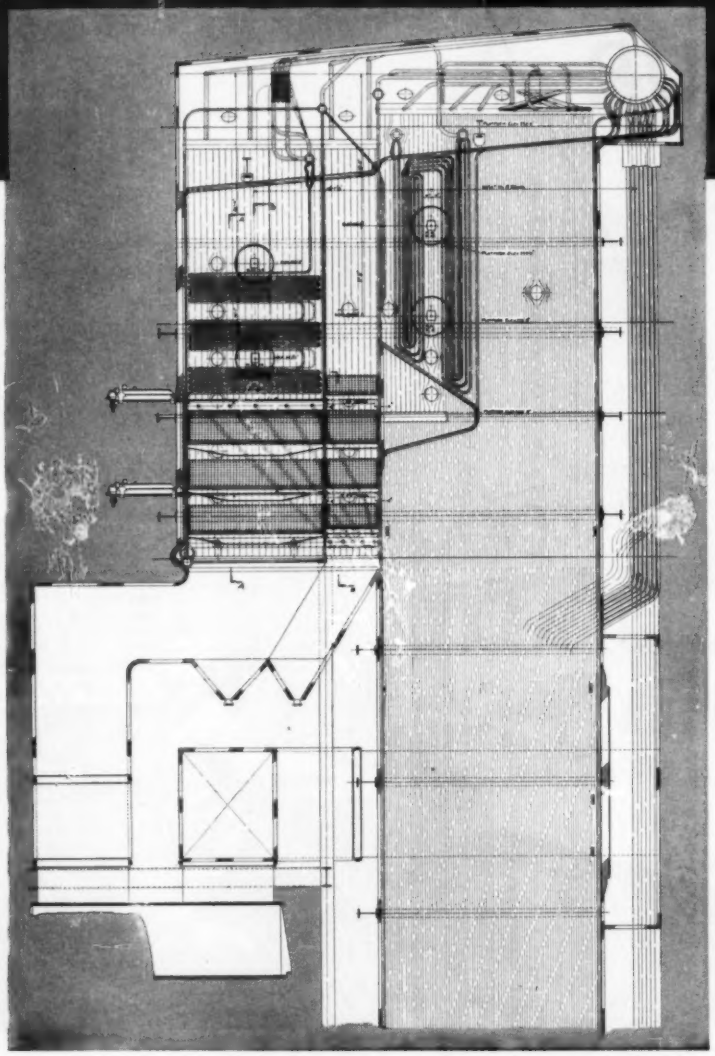
These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

It's VULCAN for



● B & W Radiant-Type Boiler fired with pulverized coal. Rated at 1,370,000 pounds of steam per hour at 1700 psi and 1050 degrees F.

● 18 Vulcan long retractables; 10 for the by-pass and economizer sections, 8 for primary and secondary superheaters. 2 Vulcan controls for air-heater cleaners. All blow with steam, under automatic-sequential control; air-driven.

VULCAN Retractomatic

HUDSON AVENUE STATION

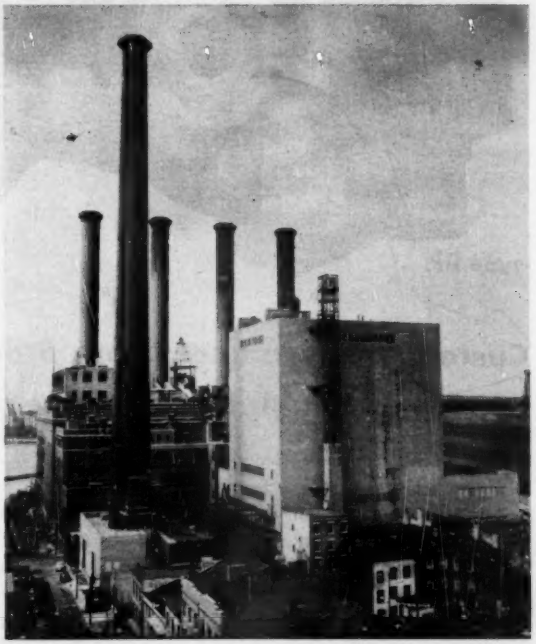
CONSOLIDATED EDISON COMPANY OF NEW YORK

FOR the eighth time, Consolidated Edison Company of New York—world's largest public utility—has purchased Vulcan to keep an important boiler free from soot and slag. This time it's for Hudson Avenue Station, where the world's first 1,370,000-pounds-per-hour boiler is being erected.

The Vulcan Automatic-Sequential Soot Blowing System includes eighteen long retractables and two special air-heater cleaners—all air-driven, all to blow with steam.

Whether you prefer to blow with air or steam, depend on Vulcan for optimum cleaning efficiency with low operating and maintenance costs. Let a Vulcan engineer show you how and why.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DuBois, Pennsylvania



Showing structural work in progress at Hudson Avenue Station for one of the world's largest boilers. General boiler arrangement on facing page.

General Electric Announces

A NEW ADVANCE IN

type DP

Custom Performance from Standard Turbine Drives now possible through new Designs and Manufacturing Methods

Now you can select the mechanical-drive turbine that will give you maximum mechanical power for your fuel dollar . . . and without the delay and expense of special engineering. General Electric's four new multi-stage drives are *standards*, designed to meet your *specific* requirements.

Four new governing systems give you a wide selection of performance ratings. A new sectional valve gives you greater efficiency for part load operation. Many other improvements make these the finest turbines of their size General Electric has ever produced.

Secret of their adaptability is in the method of manufacture. By using interchangeable casting patterns, designed to be combined in a variety of ways, it's possible for the factory to "customize" standard machines for individual applications. You get a better turbine, designed for your job, and the delivery time is shorter, the cost lower.

Get the full particulars on these new multi-stage turbine drives. Write for our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." General Electric Company, Section 252-53, Schenectady, N. Y.

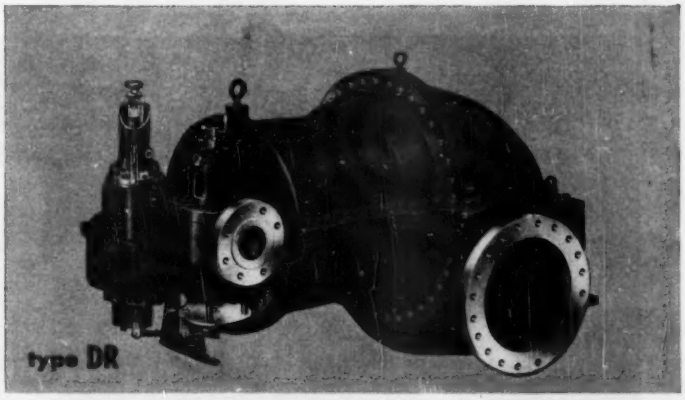
GENERAL ELECTRIC

252-53

MULTI-STAGE TURBINE DRIVES

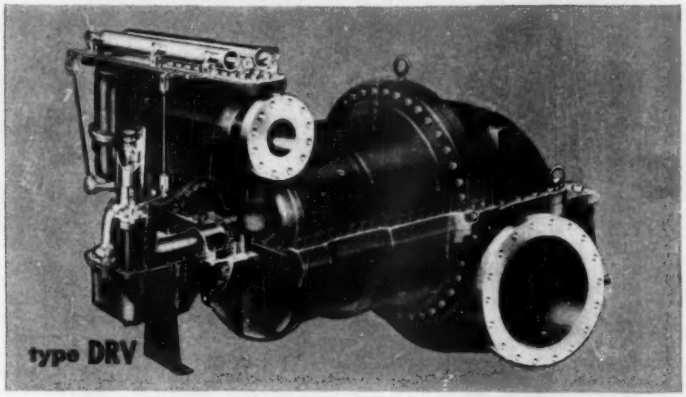
type DP

Dependable power over a 30 per cent adjustable speed range.



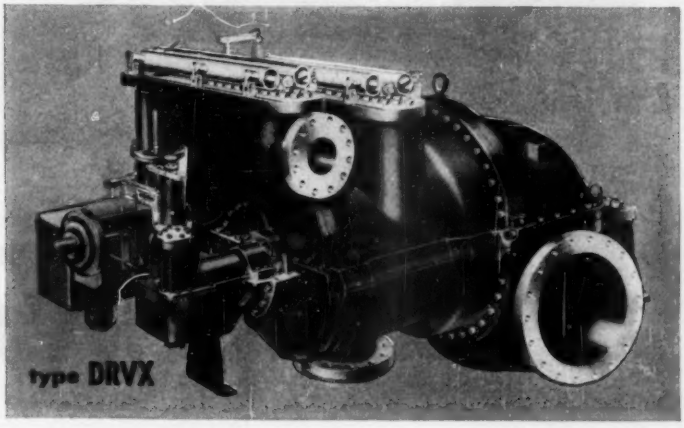
type DR

Oil-relay governor makes possible a speed range of .6 to 1, with only 4 per cent regulation and ½ per cent steady state speed variation.



type DRV

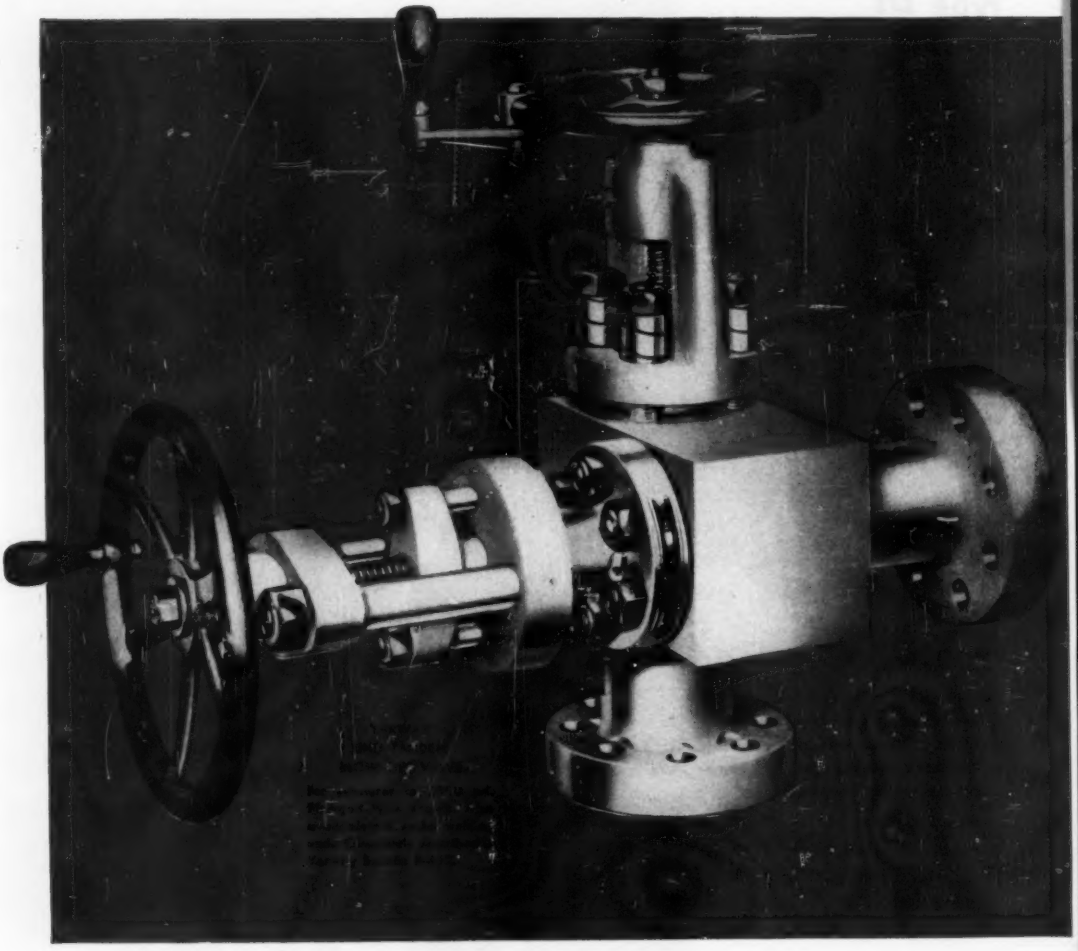
Automatic sectional valves linked to the oil-relay governor minimize throttling losses under fluctuating load factors, make possible substantial operating savings.



type DRVX

For applications where process steam is desired at a definite, steady pressure. Extracted steam pressure remains constant even when load on the unit fluctuates and the flow of extracted steam varies.

YOUR BOILER



YARWAY

IS WORTH A *GOOD* BLOW-OFF VALVE

Boilers represent sizable investments . . . certainly worth protecting with the most dependable boiler trim you can get.

You need good blow-off valves—valves that keep blow-down lines tight, don't wear, clog or leak, and are rugged enough to stand up under the severe shock of regular or emergency blowing-down under pressure.

Yarway Blow-Off Valves meet those requirements. Both Yarway Seatless Valves with balanced sliding plunger, and Yarway Stellite-faced Hard-Seat Valves embody the most recent developments in design and metallurgy.

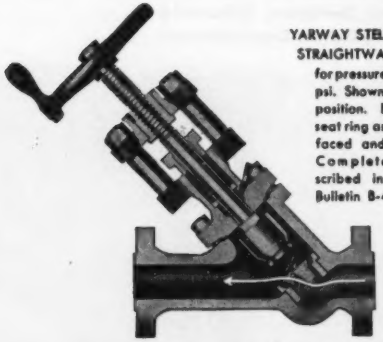
Engineers tell us the sturdiest of all blow-off valves is the Yarway Unit Tandem. This famous valve combines either a seatless and hard-seat, or two hard-seat valves, in a one-piece forged steel body. It is made for pressures up to 2500 psi. Other Yarway Blow-Off Valves meet lower pressure requirements.

It is significant that more than 15,000 plants throughout the world use Yarway Blow-Off Valves . . . and among the higher pressure plants, 4 out of every 5 are Yarway-equipped!

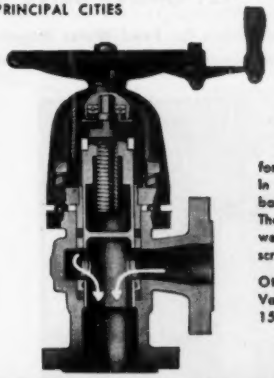
A Yarway bulletin will tell you in detail how these valves can protect *your* boiler investment. Write today, stating pressure range.

YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES



YARWAY STELLITE-SEAT STRAIGHTWAY VALVE for pressures to 2500 psi. Shown in open position. Disc and seat ring are stellite-faced and ground. Completely described in Yarway Bulletin B-432.



YARWAY TYPE "B" SEATLESS ANGLE VALVE for pressures to 400 psi. In open position. Notice balanced sliding plunger. There is no seat to score, wear, clog or leak. Described in Bulletin B-424.

Other Yarway Seatless Valves for pressures to 1500 psi.

At PLANT YATES of

. . . COPES APPLIED TO HYDRAULIC

GIVES PRECISE FEED AND LEVEL

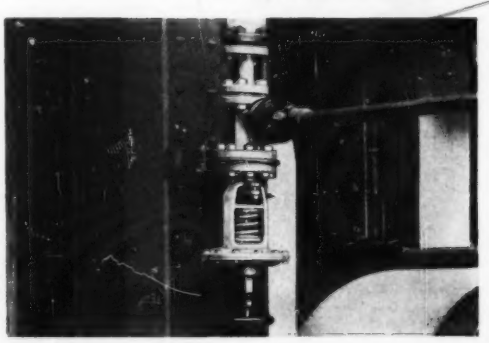
Remarkably close feed-flow and water-level control is being demonstrated daily by the COPES Balanced Flow Control at Plant Yates of Georgia Power Company, Newnan, Georgia. Units 1 and 2 went into service late in 1950.

Each unit includes a 3-drum, dry-bottom, radiant-type Combustion Engineering-Superheater boiler designed for a maximum continuous rating of 975,000 pounds per hour. Loads have been carried as high as 1,050,000—as low as 250,000—pounds of steam per hour.

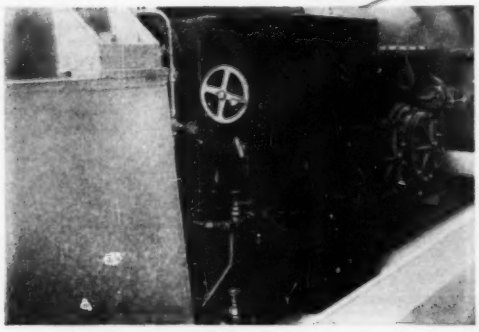
The COPES Control, applied through the hydraulic couplings of the feed pumps, matches feed flow almost perfectly to steam flow, and stabilizes water level within plus-or-minus one inch. Independent of meters and other controls, it can remain on full-automatic when they must be out of service for any reason. Duplicating COPES Control is on order for Unit 3, scheduled to start operation next winter.

NORTHERN EQUIPMENT DIVISION
Continental Foundry & Machine Company
121 GROVE DRIVE, ERIE, PENNSYLVANIA

***Headquarters for* Feed Water Regulators, Pump Governors, Differential Valves, Level Controls, Hi-Low Alarms, Reducing Valves, Desuperheaters**



COPES Recirculating Valve used with the Minimum Flow Control System to protect the pumps on light loads.



Air impulses from the COPES Balanced Flow Control actuate this controller on the hydraulic coupling to control the speed of each boiler feed pump.

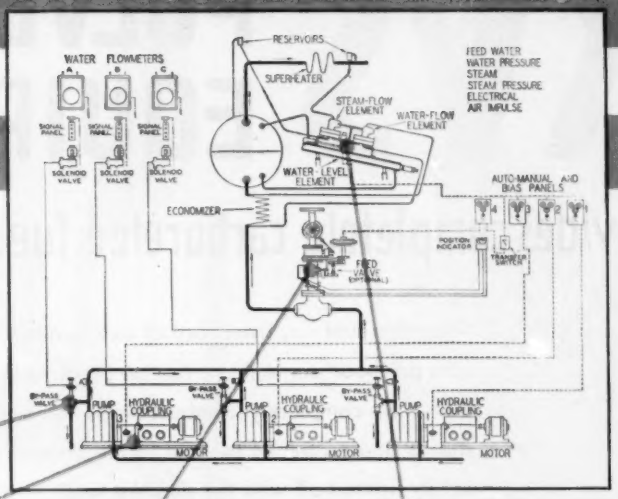
COPES

BOILER FEED

GEORGIA POWER COMPANY

COUPLINGS

CONTROL

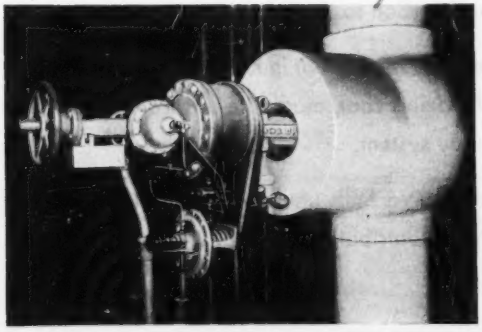


Shown schematically is the COPES Balanced Flow Control installed for each boiler at Plant Yates. Responsive to three influences—steam flow, feed flow and water level—the COPES applies air impulses to position the individual controller for the hydraulic coupling of each motor driven pump. Two pumps are normally parallelled, with the third on standby, but any pump can be cut in or out by pushing the button to start or stop its motor.

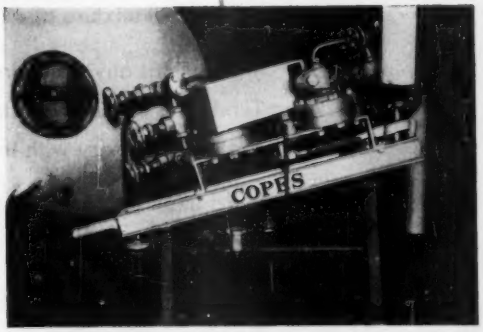
The feed valve is normally wide open, but can be cut into automatic service at any time.

COPES Minimum Flow Control protects the pumps against overheating on light loads.

How well this system controls both feed flow and water level is shown by a new COPES Performance Report which also covers installations in two other Georgia Power Company plants. Charts are reproduced, as are boiler drawings and equipment photographs. *Write for Bulletin 489.*



The COPES Feed Valve, installed in a vertical line, is normally wide open but may quickly be placed on fully-automatic, if and when this is desired.



The COPES Balanced Flow Thermostat has steam-flow and water-level elements mounted rigidly on the frame of the water-level element. It is rugged.

WATER REGULATION

KVS PULVERIZING EQUIPMENT

provides completely carbureted fuel from ANY coal

Superfine fuel . . . from coal of any quality and in quantities to 35 tons per hour per mill . . . can be prepared in KVS Air Swept Tube Mills. So completely combustible is the impalpable coal powder that is floated out of the mill to the burners that cold units can be safely lighted off with the simplest torch.

Other indications of the complete carburetion of the coal and its adequate preparation for combustion include such factors as an unburned carbon content of less than ½%, a complete removal of surface moisture from the coal in the pulverizer and the delivery of an ideal mixture of oxygen and carbon to the burners.

Inasmuch as any tramp iron which may be present in KVS Air Swept Tube Mills actaully assists in pulverizing coal, magnetic separators are not necessary with the Kennedy system.

In addition to all these advantages, KVS Mills have an experience record of 99% availability which contributes materially to low operating cost.

Kennedy Products

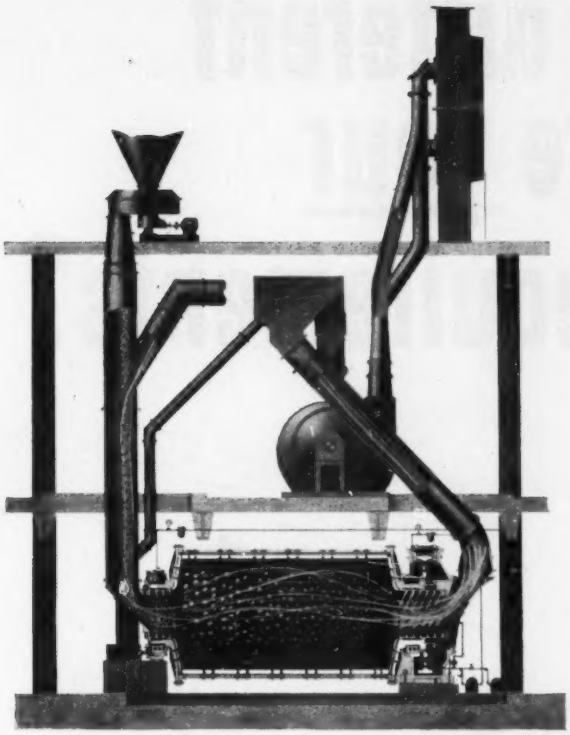
Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA



All components of KVS Steam Generating Units are engineered to meet specific operating conditions and to assure the maximum in efficiency and economy at all boiler ratings.

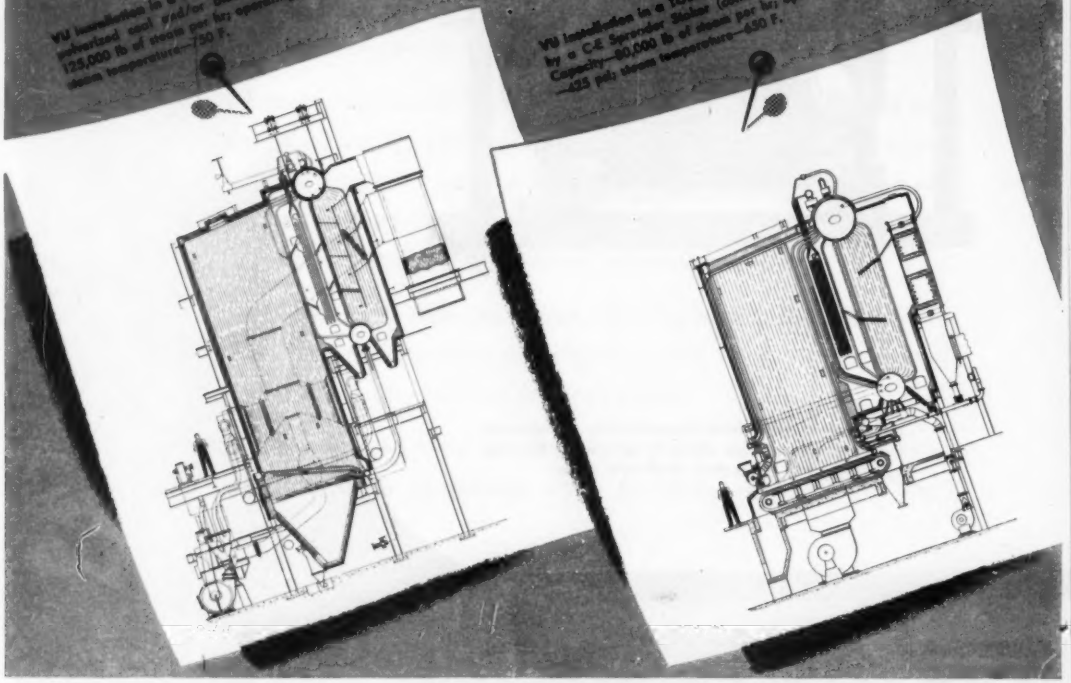
KVS ENGINEERING SERVICE

KVS is equipped to design and build complete power plants from "bunker to bus bar" in any part of the World and assume full responsibility for overall performance guarantees whether or not the equipment involved is built in KVS shops.

How different are your Steam Requirements?

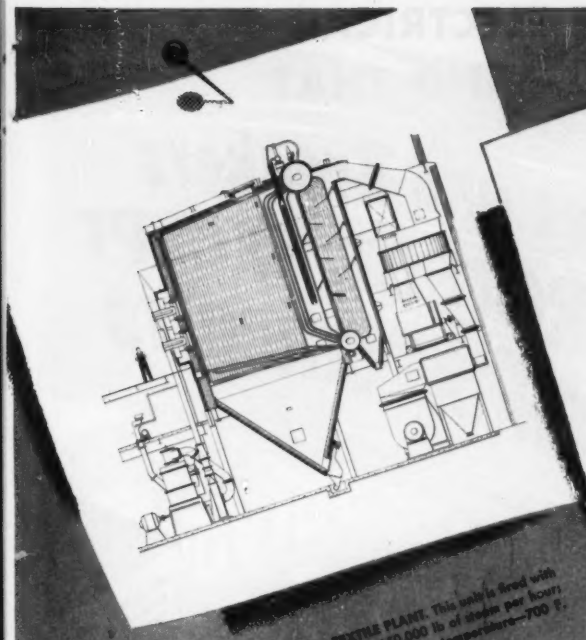
VU installation in a STEEL PLANT. This unit is fired with pulverized coal and/or blast furnace gas. Capacity—125,000 lb of steam per hr; operating pressure—850 psi; steam temperature—750 F.

VU installation in a TOBACCO PLANT. This unit is fired by a C-E Spreader Stoker (continuous discharge type). Capacity—80,000 lb of steam per hr; operating pressure —425 psi; steam temperature—650 F.

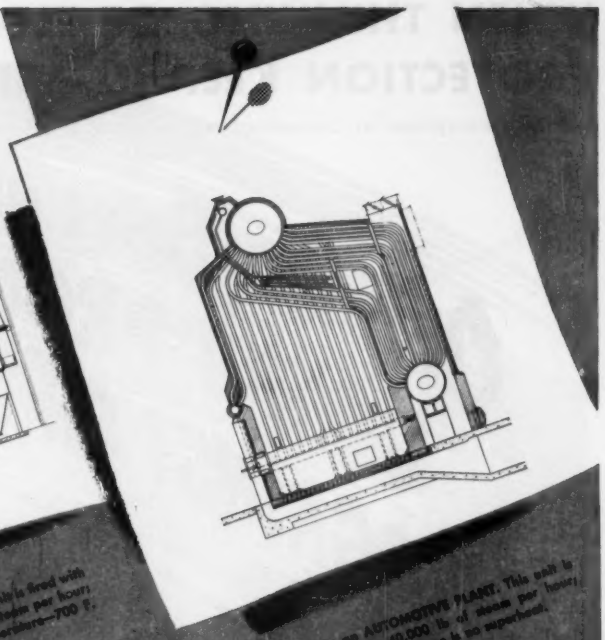


COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



VU installation in a TEXTILE PLANT. This unit is fired with pulverized coal. Capacity—150,000 lb of steam per hour; operating pressure—600 psi; steam temperature—700 F.



VU installation in an AUTOMOTIVE PLANT. This unit is fired with oil. Capacity—40,000 lb of steam per hour; operating pressure—135 psi. There is no superheat.

Every engineer knows that steam requirements vary from industry to industry . . . from plant to plant. It is virtually certain, therefore, that your particular conditions of fuel, load, capacity, pressure and temperature are not exactly the same as those of any other plant.

Yet the C-E Vertical-Unit Boiler can deliver top performance in your plant . . . just as it has done in hundreds of others . . . representing a wide variety of steam conditions.

This is because the basic design of the VU allows exceptional latitude in the selection of the *right* boiler to fit your particular requirements. It is available in capacities from 10,000 to 350,000 lb of steam per hr, with pressures from 160 to 1000 psi and temperatures up to 900 F, or more. It is adaptable to limited space conditions and to the use of any fuel or method of firing. The VU may be operated over a wide range of output, and, depending on fuels and the use of heat recovery equipment, efficiencies range up to 85%.

How well is the Vertical-Unit Boiler meeting the steam requirements of different industries? The answer is to be found in an impressive record of orders and repeat orders covering virtually every field. If you would like first hand information on the story of the VU Unit in your industry we would be glad to send it to you.

* * *

The point is that the story is the same . . . in industry after industry . . . *the popularity of the C-E Vertical Unit Boiler is widespread and steadily increasing.* Why not investigate how the variables of your requirements can be matched with the VU Unit for top performance?

C-210

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

WHEN THINKING OF ELECTRICAL PROTECTION KEEP IN M

with rare exceptions on Commercial

Fusetron dual-element Fuses—

1. * Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

COUNT 'EM

DON'T RISK LOSSES

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

Mail the coupon now for complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

(FUSETRON is a trade mark of Bussmann Mfg. Co., Division McGraw Electric Co.)

* Fusetron Fuses have high interrupting capacity shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

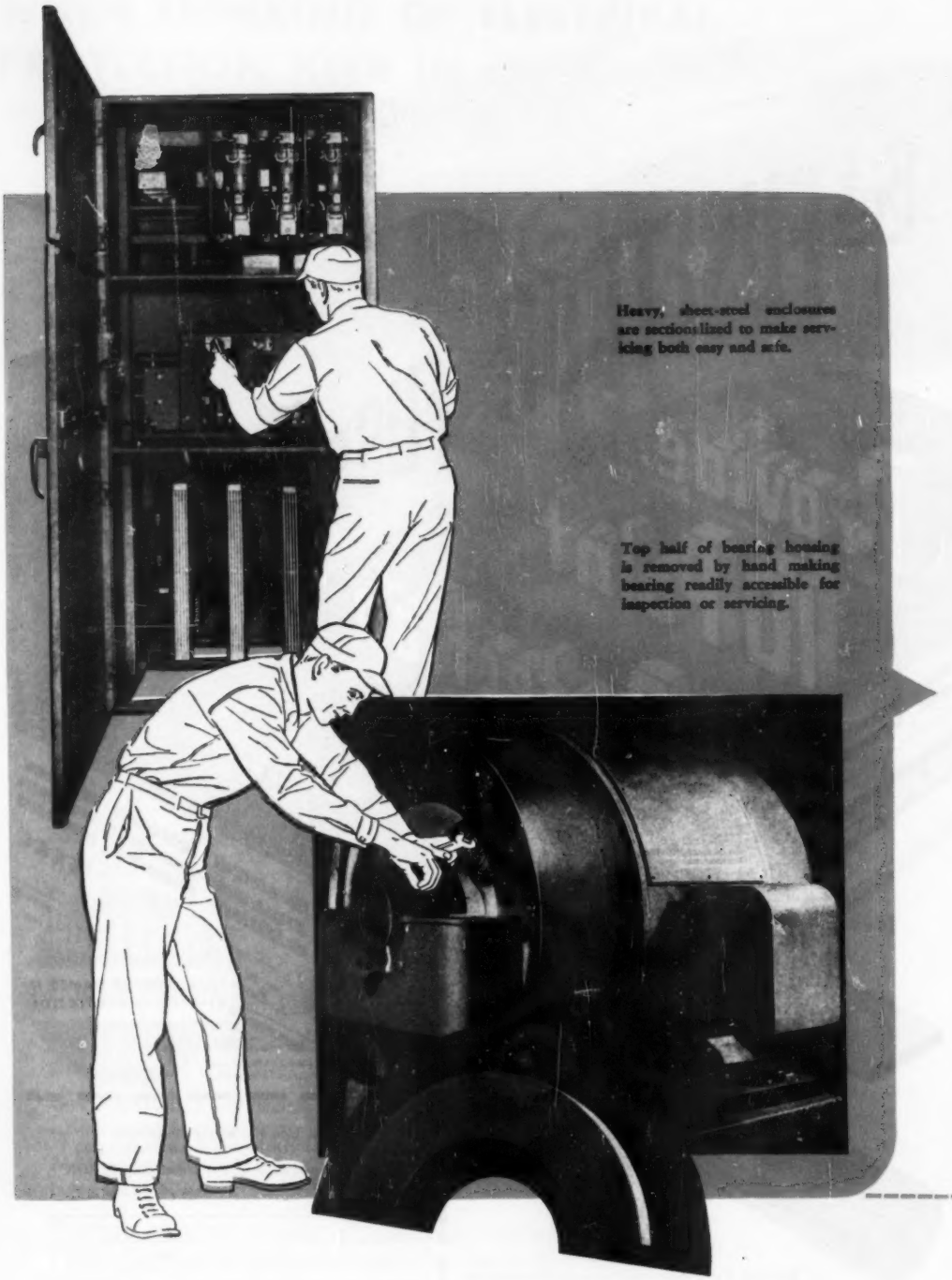
*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 152



Heavy, sheet-steel enclosures are sectionalized to make servicing both easy and safe.

Top half of bearing housing is removed by hand making bearing readily accessible for inspection or servicing.

This matched pair reduces servicing time to minutes

Every servicing operation from checking bearings to replacing contacts takes a minimum of time—without the usual muss and fuss—on this motor and control team. All components are functional in design and easy-to-get-at. No special tools are required.

On Westinghouse Large Induction Motors you simply remove the top half of the bearing housing by hand and the bearing is accessible for inspection and servicing. No top bracket to remove—no crane to lift heavy, cumbersome parts. One man and a few minutes is all that it takes.

One man can remove the motor's light, sturdy sectional covers and air shields by hand also. Here again, no crane is required—complete operation can be performed in a matter of minutes.

An occasional look in the door meets most of the servicing requirements on this Westinghouse High-Voltage Starter with air-break contactor. Simple, dependable design assures long mechanical life of the contactor and its moving parts.

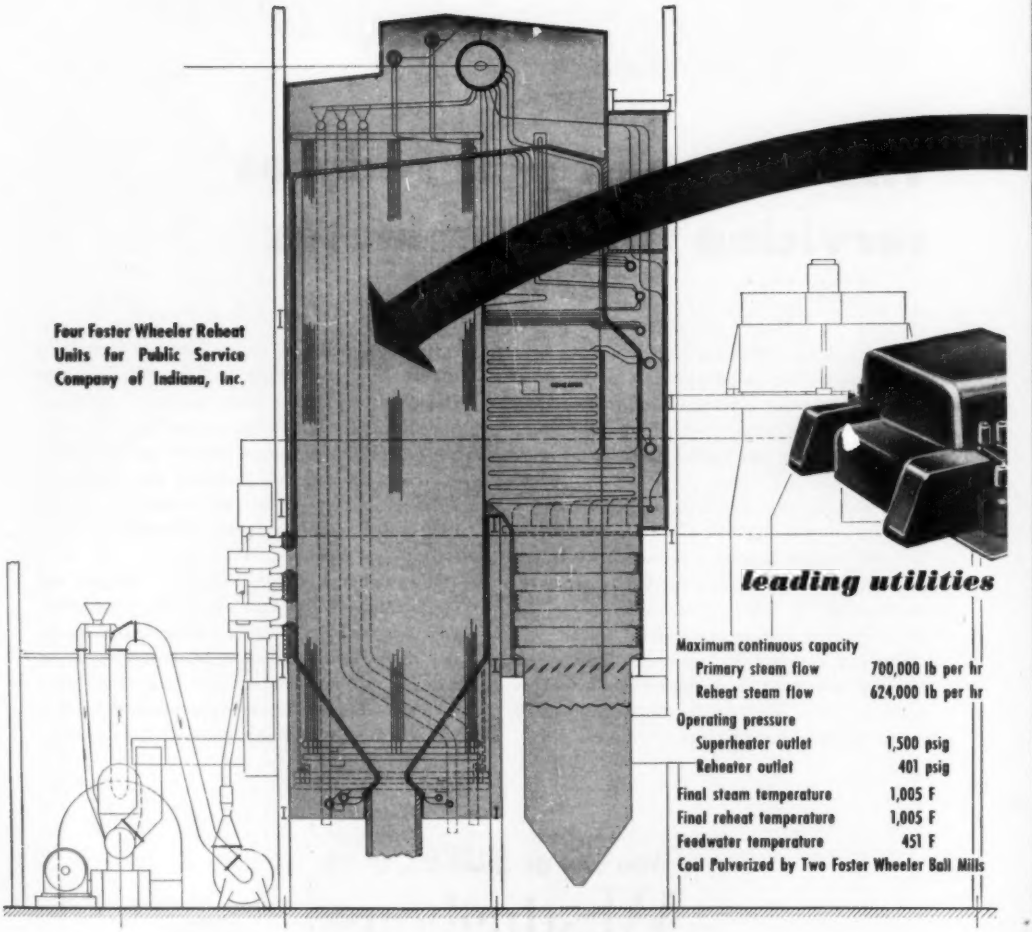
Powerful magnetic blowouts and large arc boxes effectively confine arcs—increase contact life. Built-in fuses are readily accessible . . . easy to install or replace.

Westinghouse Large Induction Motors and High-Voltage Starters are the perfect power partners. Get the benefits of their co-ordinated operation. Call your local Westinghouse representative now for complete details. Or, if you prefer, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10357

YOU CAN BE SURE.. IF IT'S
Westinghouse

LARGE INDUCTION
MOTORS and CONTROLS

Integrating

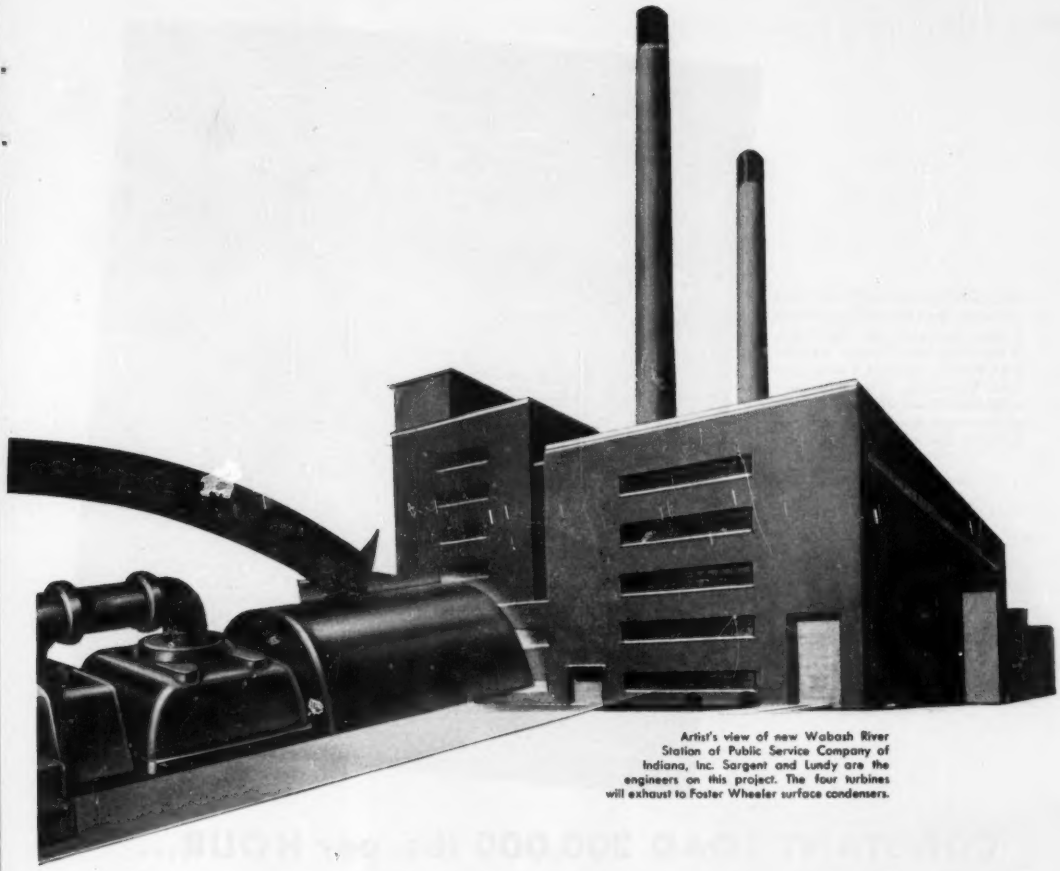


Four Foster Wheeler Reheat Units for Public Service Company of Indiana, Inc.

leading utilities

Maximum continuous capacity	
Primary steam flow	700,000 lb per hr
Reheat steam flow	624,000 lb per hr
Operating pressure	
Superheater outlet	1,500 psig
Reheater outlet	401 psig
Final steam temperature	1,005 F
Final reheat temperature	1,005 F
Feedwater temperature	451 F

Coal Pulverized by Two Foster Wheeler Ball Mills



Artist's view of new Wabash River Station of Public Service Company of Indiana, Inc. Sargent and Lundy are the engineers on this project. The four turbines will exhaust to Foster Wheeler surface condensers.

are ordering Foster Wheeler reheat steam generators

The large investment in present day power plant equipment dictates the careful selection of major components so as to avoid costly forced outages. Foster Wheeler engineers have always sought to refine the techniques of steam generation. They therefore took an early interest in the development of reheat where operating and control characteristics of the reheat boiler are integrated with those of the reheat turbine during every phase of service. Almost three decades ago, these engineers were responsible for the utilization of the characteristics of radiant and convection superheaters in series. Over "500 radiant superheater years" in one utility alone attest to the reliability of radiant surface for superheating.

The reheat steam generator illustrated is designed with a combination radiant and convection superheater and an all convection reheater. The chief advantages of this type of Foster Wheeler reheat steam generator may be listed as follows:

- complete freedom from furnace slagging is assured because furnace can be designed to suit fuel characteristics rather than reheat cycle duty requirements
- permissible wider selection of fuel of varying slagging characteristics
- location of the reheater deep in the convection zone assures safer metal temperatures during all starting, shutting down, and emergency operating conditions

This design also incorporates such features as:

- complete drainability of all superheating and reheating surfaces essential to quick and normal starts
- wide range of precise control of final steam temperature
- fully independent means of controlling primary and reheat steam temperatures.

These features provide for complete integrating of steam generating unit with turbine requirements under normal, quick start or emergency conditions.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

Engineers for the Bay Front Steam Plant of the **Lake Superior District Power Company** at Ashland, Wisconsin, were **Sargent & Lundy.** The Westinghouse Centrafire with Traveling Grate will carry a constant load of 200,000 lbs. of steam per hour, with peaks of 230,000 lbs. of steam per hour.

CONSTANT LOAD 200,000 lbs. per HOUR... another Centrafire triumph!

The Westinghouse Centrafire® with Traveling Grate now being installed for the Lake Superior District Power Company is one of the largest Centrafire units that has been ordered to date. This utility and their consulting engineers wanted a stoker that could maintain a constant load of 200,000 lbs. of steam per hour . . . with peaks of 230,000 lbs. of steam per hour . . . despite continuous feeding of wet and storage coal. Moreover, they needed a stoker that could absorb foreign objects in the coal, without interruption or damage to the apparatus.

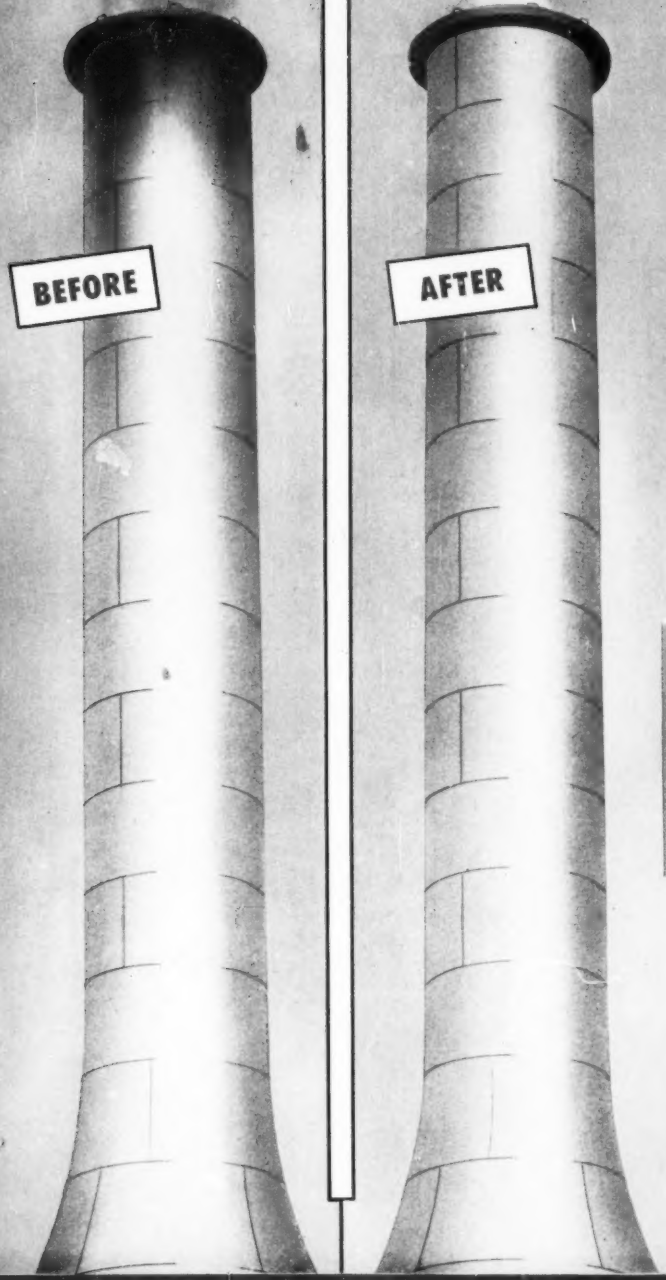
The ability of the Centrafire to "take it" and continue without load loss under severe conditions has been demonstrated in factory tests and in power plant installations. Wet coal, storage coal, bricks, blocks of wood, insulators, cable, bolts and many other foreign objects have been deliberately introduced into the feeders with no adverse effect.

There are many other features that make the Centrafire outstanding . . . they're built into the basic design, not added as accessories. Whether your application calls for 50,000 lbs. of steam per hour . . . or 350,000 . . . the Centrafire with Traveling Grate offers advantages you should investigate. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-30537

STOKERS

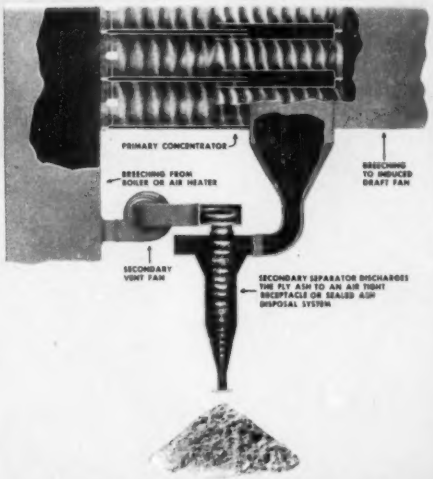
American Blower . . . a time-honored name in air handling



Installation of an American Blower Type ST Fly Ash Precipitator can make the difference shown here.

On a given application, as the load falls off and fly ash becomes harder to catch, the ST Precipitator automatically maintains a higher efficiency than any other collector of mechanical type.

Contact the American Blower or Canadian Sirocco Branch Office nearest you. They are conveniently located throughout the United States and Canada to provide complete information concerning the benefits of installing fly ash precipitators in your plant to meet your specific needs. Call on one today.


PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
BREECHING TO INDUCED DRAFT FAN
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

AMERICAN BLOWER

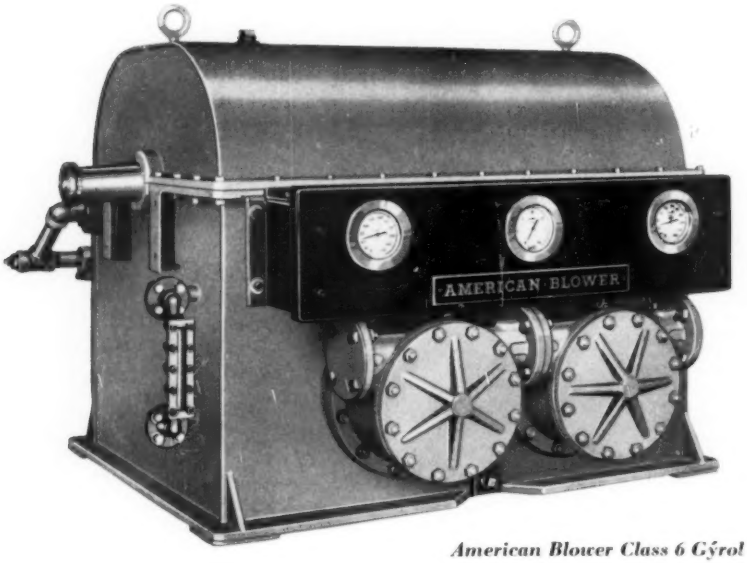
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

American Blower . . . a time-honored name in power plant equipment



American Blower Class 6 Gyrol Fluid Drive

Memo to Power Plant Men—

You can enjoy important power savings, flexible stepless control, reduced maintenance, and get lower pressures at reduced flows for your boiler-feed-pump operation. Install an American Blower Adjustable Speed Gyrol Fluid Drive with a constant speed driving motor.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

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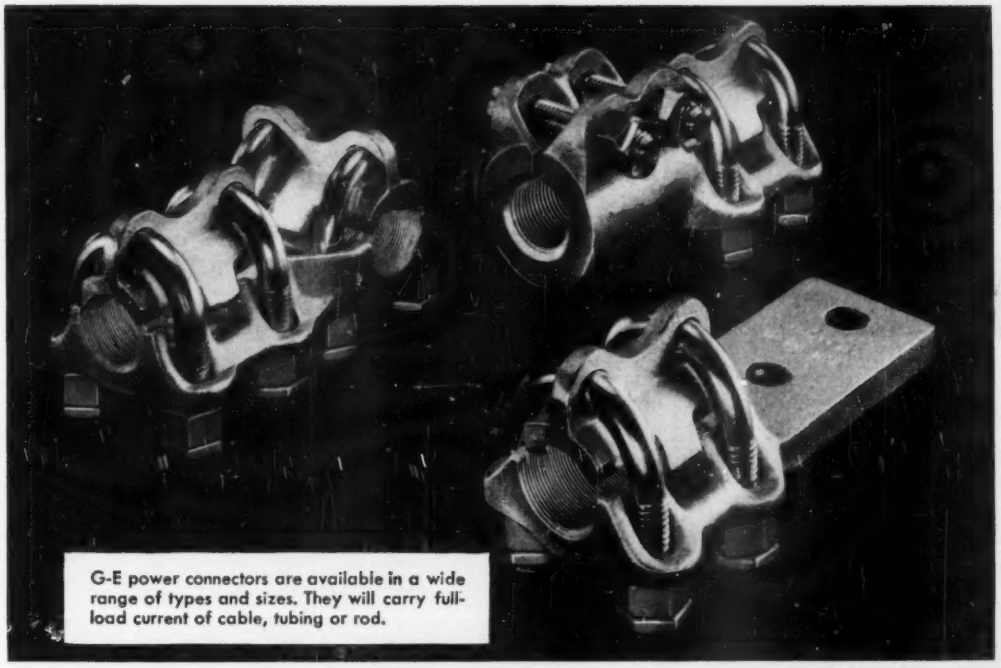


G-E power connectors are available in a wide range of types and sizes. They will carry full-load current of cable, tubing or rod.

Make power connections and forget 'em . . . when you use G-E Power Connectors!

With G-E power connectors, you get a permanent, high conductivity joint that resists vibration and maintains positive contact with the conductor at all times.

Low contact losses Silver on all current-carrying surfaces minimizes contact resistance—protects against formation of troublesome copper oxide. Interlocking sides confine cable strands within the enclosure, reducing inter-strand resistance. Carefully regulated copper content of connector alloy assures current-carrying ability equal to that of conductor. As a result, G-E connectors "run cool" —preventing oxidation through overheating.

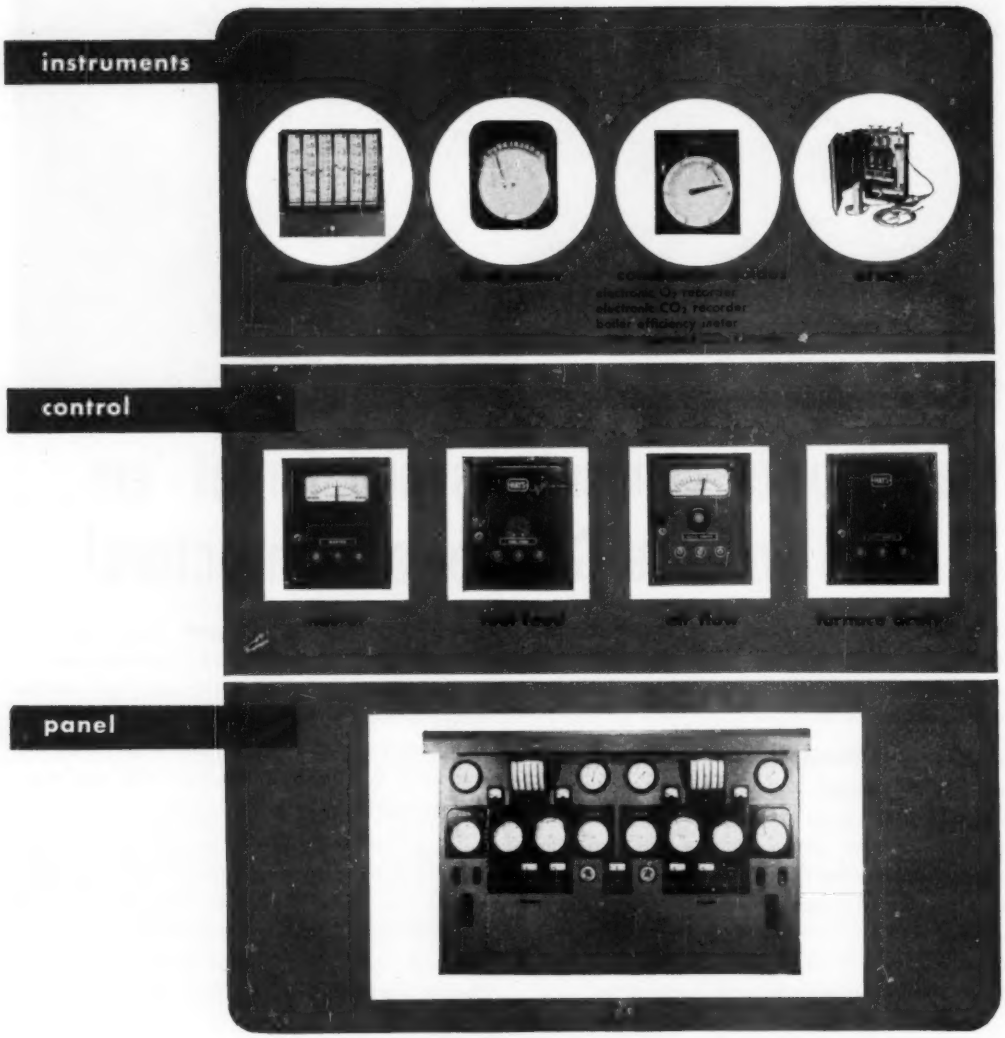
High mechanical strength Sharp, machine-serrated contact surfaces bite into the conductor—providing extremely high pull-out strength and the ability to resist vibration. Noncorrodible hardware of high-strength bronze alloy maintains permanent tightness. G-E power connectors will not twist, distort or season crack.

Types include straight, tee, block, angle, expansion, ground and many others. Why not place a trial order with your G-E sales representative today? Write for Bulletin GEC-400—it contains 44 pages of valuable connector information. General Electric Company, Schenectady 5, N. Y.

956-77

GENERAL ELECTRIC

This HAYS boiler plant line



can give you *results* like these

Increased efficiency "Our basic reason for installing the Hays electric automatic combustion control was to obtain better efficiency. Our aim was more than reached . . . efficiency has climbed, attaining 79.3%."

Plant Engineer
Manhattan Rubber Div.,
Raybestos-Manhattan, Inc.

Rapid response to wide load swings "We have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs. per hr. with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%."

Chief Engineer of Power Plant
Bemis Bros. Bag Company

Good CO_2 "The (Hays) controls in combination with our instruments make it possible to maintain high efficiency, as indicated by the 14½% average. CO_2 obtained, and keep complete records of our operation."

Chief Engineer
Geo. Ziegler Company

Low maintenance "Our aim has always been to eliminate the need for maintenance wherever possible . . . and we are particularly pleased that maintenance has been 'nil' with the (Hays) automatic combustion control system."

Chief Engineer
Kurth Malting Company

Fuel savings "Our fuel cost per pound of steam has dropped so much since we installed (Hays) instruments and combustion control, that fuel savings alone have been enough to pay for the investment in one year's operation."

Power Plant Chief Engineer
Vollrath Company

Efficiency and savings "The Hays combustion control system has played a large part in enabling us to reduce our fuel bill by 20% as well as to achieve an 81% boiler efficiency rating (by metering tests)."

General Power Engineer
Pullman Standard Car Mfg. Co.

tailored to your specifications

Your conditions are different . . . and Hays engineers tailor the instruments, control and panel to *your* requirements.

The result? A control system "customized" for your boiler rating, fuel(s), load swings, steam demand, etc. . . . designed to solve the specific problems which plague you . . . with all instruments and controls mounted on a handsome panel laid out, built, and painted according to your instructions.

how to get results

Hays application engineers will provide consultation on the special problems facing your plant. Through careful analysis, working with your actual operating conditions, they will recommend methods to achieve the results you want. Send us a brief statement of your combustion problem for specific preliminary recommendations, without obligation. Ask for Bulletin No. 49-605 and actual case histories of a wide variety of applications.

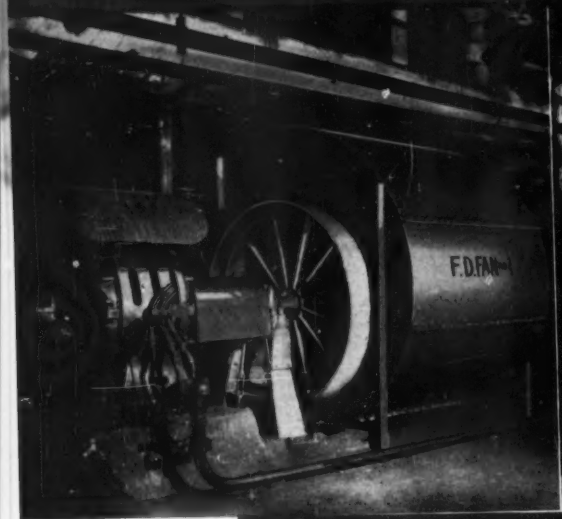
THE HAYS CORPORATION
MICHIGAN CITY 3, INDIANA

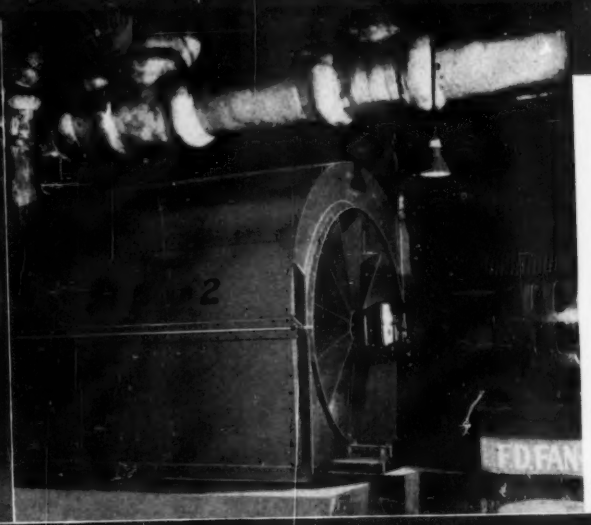
Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

Further Proof

Buffalo

DRAFT LAST LONGER





BUFFALO FORGE

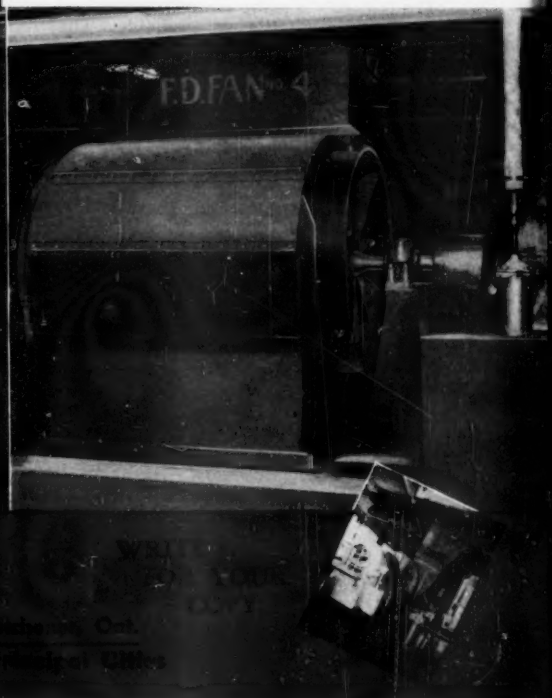
468 BROADWAY, BUFFALO, NEW YORK

FANS

. . . THESE FANS IN CHAMPION PAPER AND FIBRE CO.'S OLD BOILER PLANT WERE BUILT IN 1917!

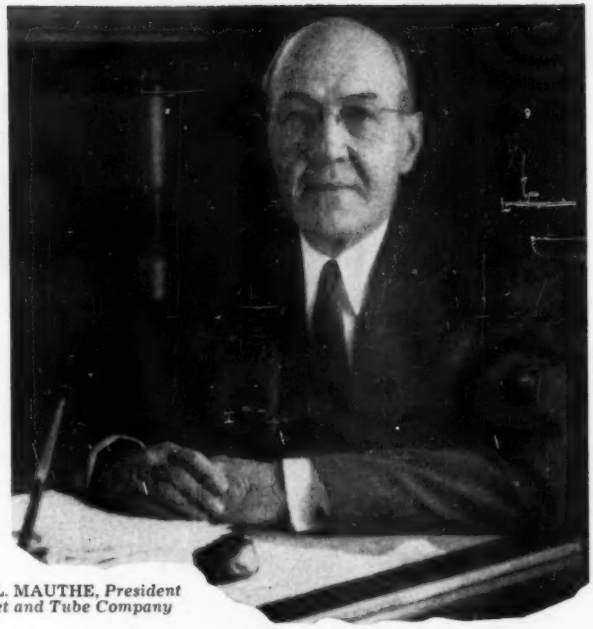
iler house in 1925, these "Buffalo"
ular service until 1931 . . . and were still in
dby service ever since!

ce record for forced draft fans.
ffalo" installations, industry-wide have been
rance — less trouble on the
ife. Why not write for Bulletin 3750
ffalo" draft fans offer you?



Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

Why is the scrap situation so critical?



An interview with J. L. MAUTHE, President
The Youngstown Sheet and Tube Company

Why are you concerned about iron and steel scrap, Mr. Mauthe?

Our inventories are critically low and the present scrap flow is not sufficient to maintain capacity steel plant operations. Furthermore, if the flow of scrap is not increased, a curtailment of steel production is inevitable.

The industry is using all the pig iron and all the home scrap that is available. The balance of our metallic requirements must be made up through procurement of purchased scrap. Every ton of scrap that we do not get represents a ton of steel that we cannot make.

How much scrap does the industry need?

In 1950, 96,700,000 tons of steel ingots and castings were produced, requiring over 61,000,000 tons of iron and steel scrap.

In 1951, over 65,000,000 tons of scrap will be required, and even more will be needed in 1952.

Where does scrap come from?

About 58% of the total scrap required is produced by the ingot and casting makers, and is known as "home" scrap; the balance of 42% is "purchased" scrap and is procured from outside sources.

Purchased scrap generally falls into two categories: Scrap from current fabrication and that which is the result of obsolescence.

There are three important sources from which we get obsolete scrap, much of which is dormant:-

1 - Obsolete machinery and equipment in every industrial plant, at the oil fields and on the farms.

2 - Battlefield scrap, obsolete ships and war material, surplus machinery and equipment, which government can make available.

3 - Countless old automobiles and trucks, which are rusting away in automobile wrecking yards in every section of the country.

What can be done to increase tonnage of purchased scrap?

This scrap must be made available immediately! All industry and government must awaken to the critical nature of the situation. They must realize that if we do not get the scrap, they will not get the steel!

YOU CAN HELP - YOU MUST HELP!
NO SCRAP - NO STEEL

QUALITY YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company - Youngstown, Ohio

Coal Saver in Action!

AKON

DECREASED BLOWDOWN CUTS FUEL COST FOR BOILERS

BOILER BLOWDOWN wastes many tons of your coal every month.

The primary job of *Akon* treatment is to keep that waste at a minimum. *Akon* treatment takes sludge particles out of circulation harmlessly, forming *non-adherent* flocs which can be removed by less blowdown than would otherwise be required. In turn, less blowdown means savings in coal, water and chemicals . . . and no sludge deposits remain.

Akon treatment is also an excellent oxygen absorbent; it effectively scavenges traces of oxygen not removed by deaerators. Thus, both corrosion and the ills due to sludge are corrected by this one treatment.

Give your boilers the treatment they deserve. For sludge control and oxygen scavenging, use *Akon* treatment for boilers.

Akon is an Allis-Chalmers trademark.

SEND FOR the two Allis-Chalmers bulletins, BLOWDOWN (No. 28X7731) and *AKON* (No. 28B7408). In these concisely written bulletins you will find material helpful in training personnel for your power plant and valuable information on blowdown problems.

Allis-Chalmers
Milwaukee 1, Wisconsin

Gentlemen:

Please send me bulletin number

☐ 28X7731 on Blowdown

☐ 28B7408 on Akon treatment

Name

Title

Company

Address

City State

A-5839

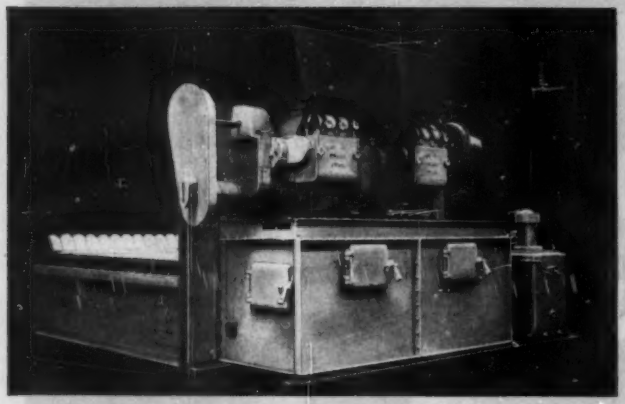
ALLIS-CHALMERS

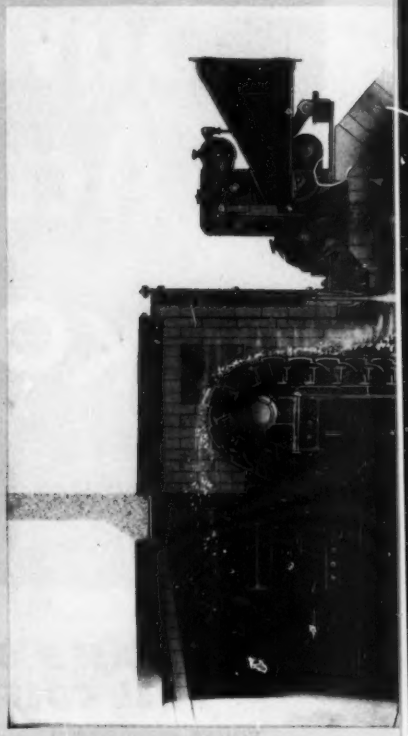
Water Conditioning

✓EQUIPMENT ✓CHEMICALS ✓ SERVICE

"TRAVA

MOST MODERN DEVELOPMENT



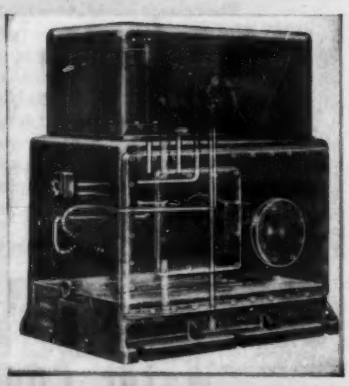


by ERIE CITY

The Erie City TRAVAGRATE Spreader Stoker, for continuous ash discharge operation, is the latest addition to the Erie City Stoker line. It incorporates simplicity, easy regulation and rugged construction. Among the many TRAVAGRATE features are: Selective feeder speed for wide ranges of fuel size and consist; flexible fuel control to assure proper distribution to all parts of the moving grate; a range of grate speed satisfactory for all loads and infinite speed selection between zero and maximum rate of travel. For the complete Erie City Spreader Stoker story write for catalog SB42-A.

A Compact Hydraulic Unit drives the TRAVAGRATE

The self-contained hydraulic drive unit is contained in a single housing without external piping. The fluid drive transmits power to the main drive shaft through a linkage and ratchet gear. A single control valve regulates speed. The drive requires no shear pins since the relief valve opens to protect the equipment should the need arise.

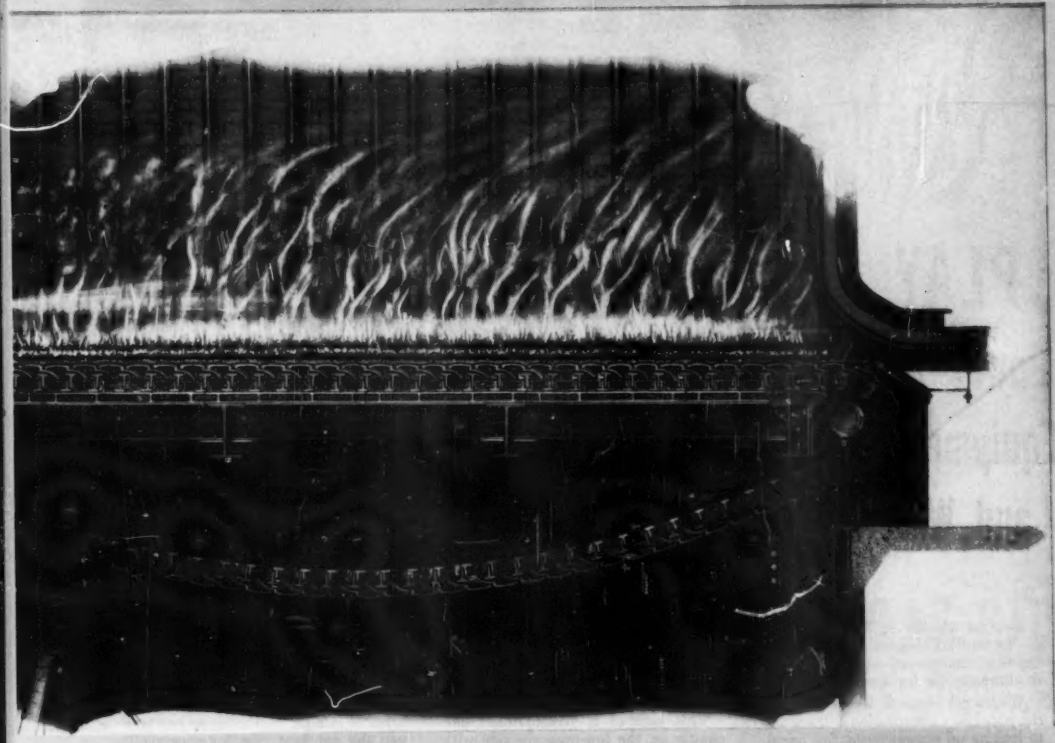


ERIE CITY IRON WORKS

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED and SPREADER STOKERS • PULVERIZERS

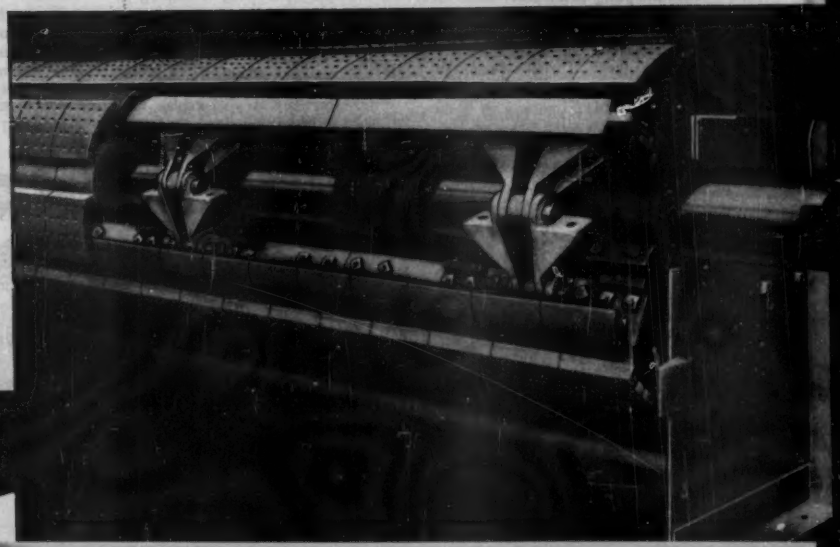
GRATE"

IN SPREADER STOKERS

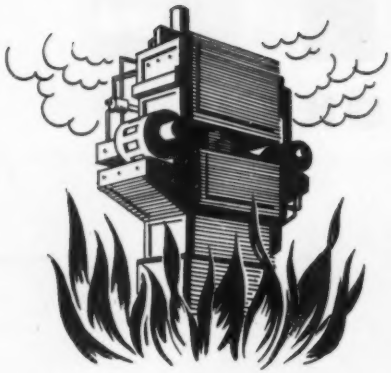


Ruggedness is Built into the TRAVAGRATE

Removal of grate sections shows the husky drive shaft and heavy duty sleeve type bearings. All bearing lubrication is provided from a central location outside the stoker structure. . TRAVAGRATE grate sections do not separate as they turn around the sprockets. Each grate section fits snugly but in such a manner that replacement can be made quickly.

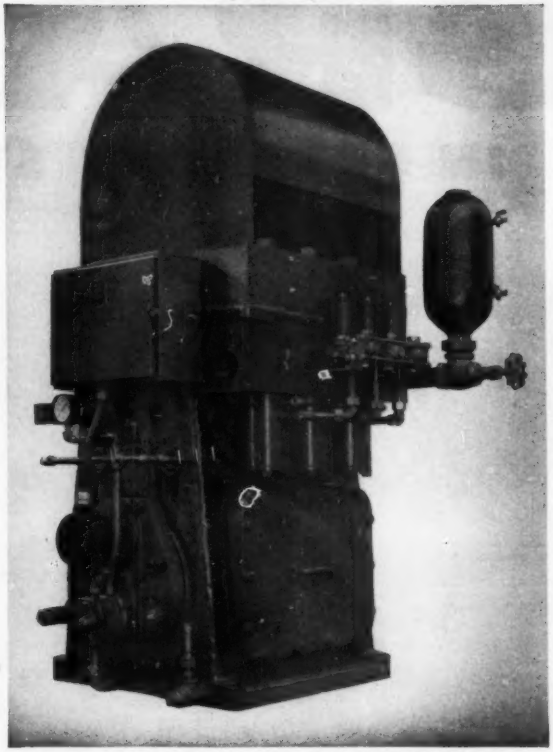


Erie, Pa.



PLAY SAFE–

Power Your Hydraulic Equipment with Water... and WORTHINGTON



Worthington VTE pump equipped with unloader, used in hydraulic systems for generating pressures.

Current practice in the engineering of hydraulically-operated machinery shows a trend toward *water*... in order to eliminate the fire and toxic hazard.

Where oil is used, there is always the possibility of explosion and fire due to leaking oil encountering hot metal.

And the pump that's best—most efficient, most economical—for furnishing a central system with water under high pressure is Worthington's high-speed VTE (vertical triplex enclosed).

This constant speed power pump is equipped, for this purpose, with Worthington's suction valve unloader. It is the only high-speed vertical pump on the market with such a device.

Automatic Control for Intermittent Operation

This device, built around an electric synchronizing distributor, unloads each cylinder in sequence, providing quick but gradual decelerating of fluid delivery, from full to zero flow, in not more than one revolution of the pump.

This control is accomplished efficiently on the low-pressure side with no shocks in unloading or loading. It permits operating the pump at speeds of 400-500 rpm.

Complete Line— of Pumps, of Auxiliaries

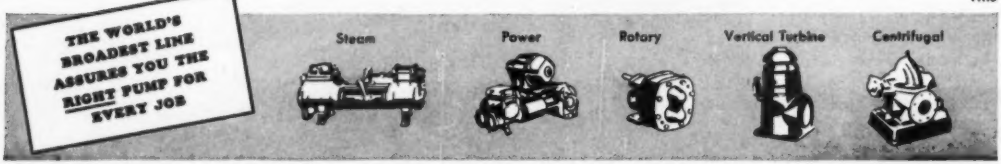
Worthington makes a complete line of pumps—and auxiliaries too—for all hydraulic power services, including horizontal and vertical power pumps, centrifugal, steam, and rotary pumps. Only Worthington gives you such a range of choice. Manufacturing *all* types of pumps, Worthington can give you the one best type for *your* application.

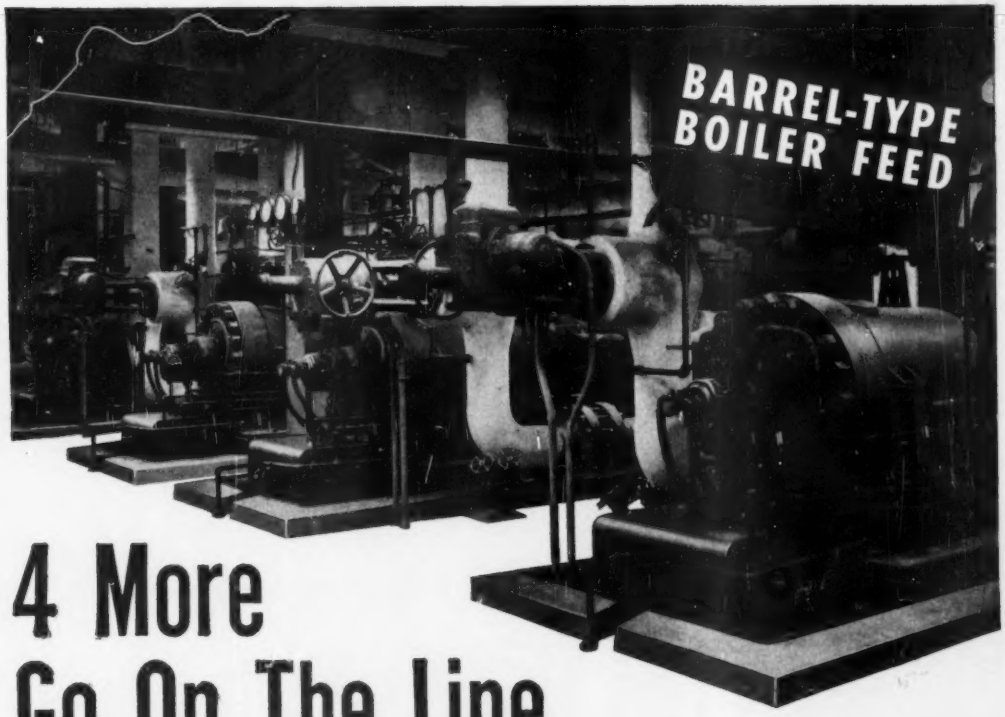
For further description of Worthington equipment for hydraulic systems, information proving *there's more worth in Worthington*, write to Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.

WORTHINGTON

P.1.5

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB





4 More Go On The Line

AT NEW HAWTHORN STATION, KANSAS CITY

Over 50 of these pumps have been bought by utilities on their proved performance record.

NEWEST PLANT OF KANSAS CITY POWER & LIGHT CO. is the Hawthorn Steam Electric Station on the Missouri River. This station, designed with every modern feature for dependability and low cost operation, has an initial capacity of 132,000 kw from two turbines and is already building an addition that will add almost another 100,000 kw from one additional turbine.

The boiler feed pump arrangement, pictured above, consists of four Allis-Chalmers 8" x 8" barrel-type boiler feed pumps with a capacity of 700,000 pounds per hour each at a discharge pressure of 1625 psig. They are driven by 1750 hp, 3600 rpm motors.

The unit now under construction also will be served by Allis-Chalmers barrel-type boiler feed pumps. Three pumps with a capacity of 425,000 pounds per hour at 1815 psig driven by 1250 hp, 3600 rpm motors are now being built.

Engineering Features

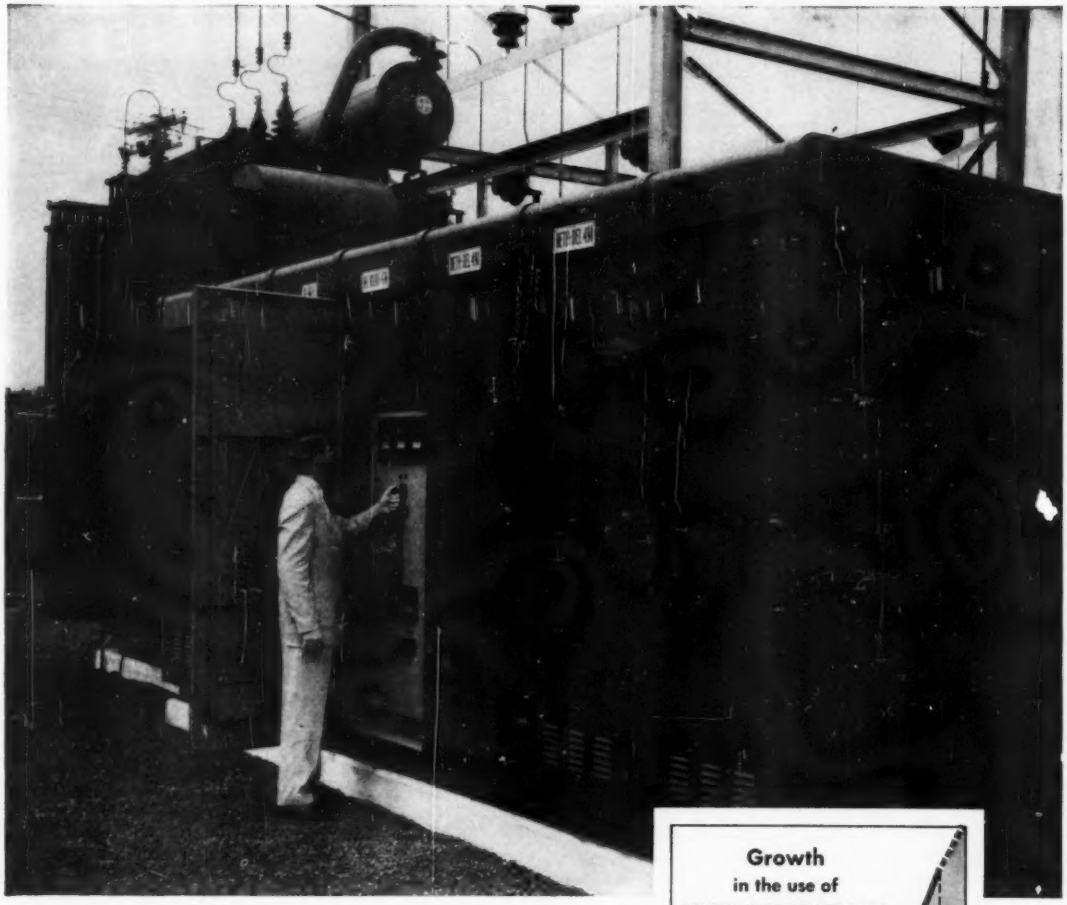
Unique engineering features designed to increase reliability and reduce maintenance have been proved in operation. Single-stage, back-to-back impellers balance axial forces without the use of a balancing drum. First stage has twin, half capacity impellers to give the advantages of low NPSH. Expansion joint is brought to the outside of the pump where leakage may be quickly detected and adjustments made without dismantling the pump. No flexible internal members are required to compensate for expansion.

Sizes range from 1200 to 3000 psig and from 300 to 2500 gpm. Allis-Chalmers can supply the complete boiler feed pump installation including pump, motor and control of coordinated design and manufacture.

Get the details on this modern-design, performance-proved boiler feed pump from your Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3522

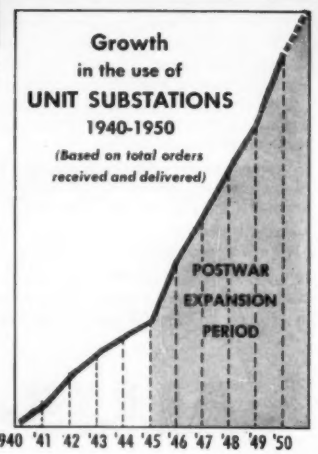
ALLIS-CHALMERS

Niagara Mohawk EXPANDS FAST at



NIAGARA MOHAWK ADDS 10,000 quickly and easily with third and fourth G-E master unit substations (5000 kva each). The one above transforms 33 kv to 5.04 kv. Open compartment door shows operating panel for magne-blast breaker. More details in photos on opposite page.

WHAT DOES THIS TREND MEAN? Savings in time, money and materials are becoming more and more important. It also means that adaptable compact unit substations have proved to be perfectly suited in cases where "special designs" were thought necessary. You get plenty of flexibility when you use G-E packaged substations.



low cost—with G-E Unit Substations

CIRCUIT BREAKERS are safely and easily removed for inspection. This view shows rear of Niagara Mohawk's new G-E metal-clad transformer main breaker in operating position. Breaker cannot be lowered for removal until it is tripped and power circuit interrupted.

YEARS OF MAINTENANCE-FREE SERVICE ahead for transformers in Niagara Mohawk's new unit substation. Bus regulation of voltage is provided by load-ratio-control equipment. Experience shows G-E LRC equipment requires very little maintenance.

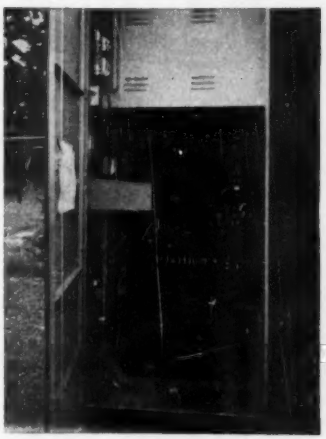
FORESIGHT PAYS OFF again and again. Above is section of older G-E master unit substation installed by Niagara Mohawk in 1939. Growing loads posed no problem—new unit (barely visible, upper left) installed alongside, capacity increased by 5000 kva.

Quick, easy ordering and installation help Niagara Mohawk expand fast to meet increased demand in Albany area

Like many other utilities and industrial plants, Niagara Mohawk Power Corp. has shown it pays to use "packaged" power equipment. In this locality, they've chosen a standard distribution system (in this case: primary network) and a standard load increment, or "building block" of power (5000-kva). As load grows, a duplicate substation of this capacity is tied into the system, always a jump ahead of demand.

A G-E unit substation arrives ready for use—you simply spot in place, connect, and energize. You save not only on equipment and installation costs, but also valuable engineering time to use for over-all planning.

These are just a few reasons for the fast-growing trend to unit substations shown in the chart on the opposite page. Your local G-E representative can show you plenty of others. Call or write him. *General Electric Company, Schenectady 5, N. Y.*

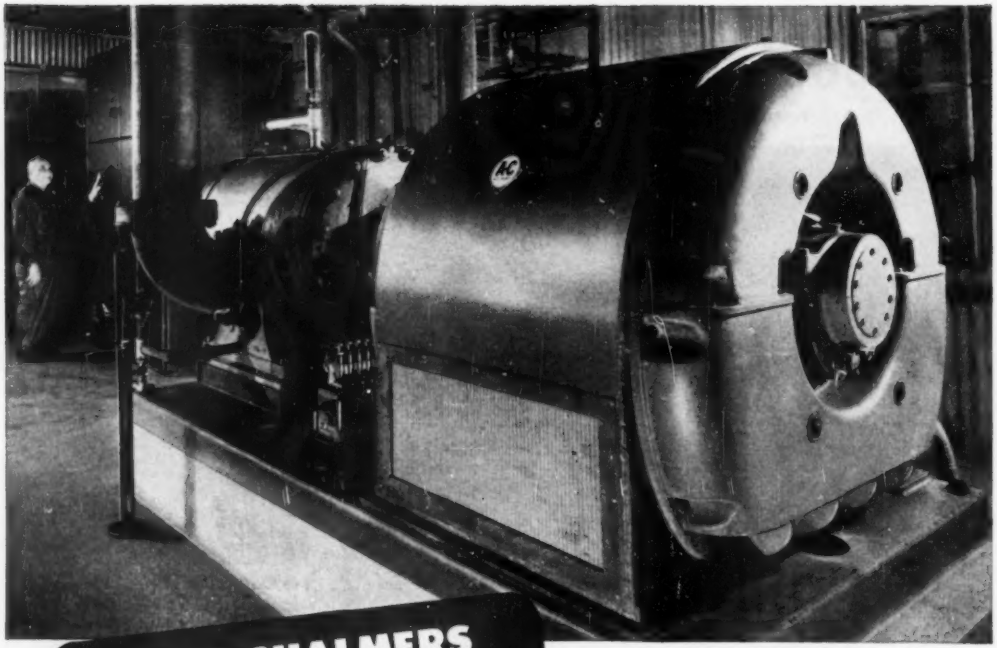


EXTRA SAVINGS MADE BECAUSE OF FLEXIBILITY

IDEA TO SAVE MONEY: Photo above is close-up of G-E metal-clad auxiliary compartment, installed with rest of Unit Substation. Flexibility permitted Niagara Mohawk to install 48-volt battery, charger, telephone. By doing this instead of using special construction, Niagara Mohawk estimates they saved $5000 to $8000.

321-80

GENERAL ELECTRIC



All Allis-Chalmers installation: 250-hp, 495-rpm, drip-proof cage motor; single-stage rotary compressor; controller.

ALLIS-CHALMERS Large Motors ... Provide Low-Maintenance Reliability

START with construction features that have already earned a reputation for ruggedness and reliability. Add all-around drip-proof and mechanical protection. And do this without sacrificing accessibility for routine maintenance.

That's how Allis-Chalmers large cage motors were redesigned. That's why you'll want these advantages in your new motors:

IMPORTANT FEATURES

- Rigid cast-iron end shields assure you of correct bearing alignment and corrosion resistance as well as drip-proof protection.
- Capsule-type bearing housings enable you to leave the bearings and oil supply sealed against abrasive dirt when you remove the top halves of the end shields to clean the windings.
- Large air discharge openings in the yoke invite you to keep the ample passages back of the stator core clean and unobstructed. They also make installation easier.
- Louvers on air discharges and design of intakes keep foreign objects out of the motor.

A-3561

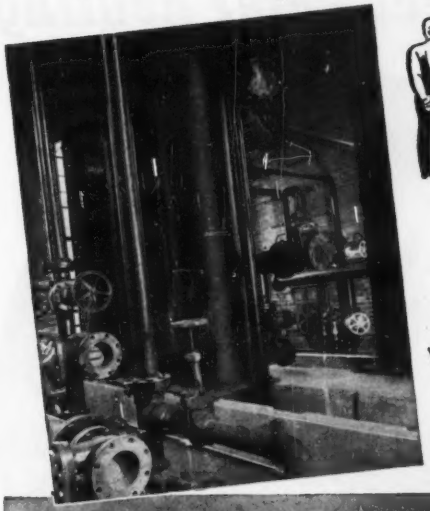
NEW BULLETIN

Built in ratings from 60 hp at 300 rpm to 1750 hp at 1800 rpm, these cage motors are described in detail in bulletin 05B7542A. Ask your nearby Allis-Chalmers representative for a copy, and see for yourself why these redesigned motors provide a new low in maintenance and a new high in reliability. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Dirty Water can't "Shut-down"...

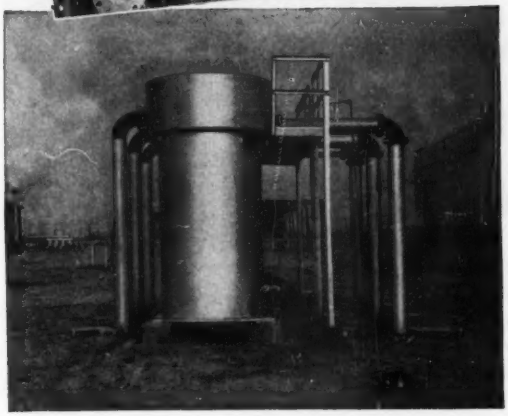
Vogt



film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

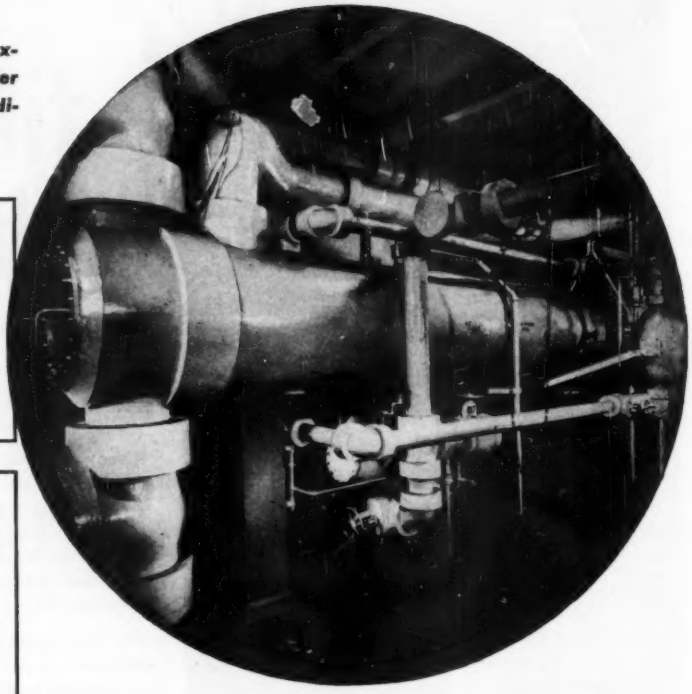
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

CONSIDER THESE

3 Factors

for best results in feedwater heating

Here's why you can be SURE of exactly the right feedwater heater for your particular plant conditions when you consult G-R.



1

COMPLETE LINE . . . a type for every pressure and capacity . . . a selection of three designs of stationary heads . . . four designs of floating heads . . . straight-tube or U-tube bundles . . . any combination of condensing, sub-cooling, and desuperheating in a single shell.

2

EFFECTIVE DESIGN DETAILS... breech-block head for high pressure . . . pass partition sealing plates for prevention of leakage between passes . . . special baffles for steam guidance and prevention of tube erosion . . . special air and drain baffles for improving thermal efficiency.

3

60 YEARS OF EXPERIENCE in designing and building feedwater heaters . . . many hundreds of units in stationary and marine service.

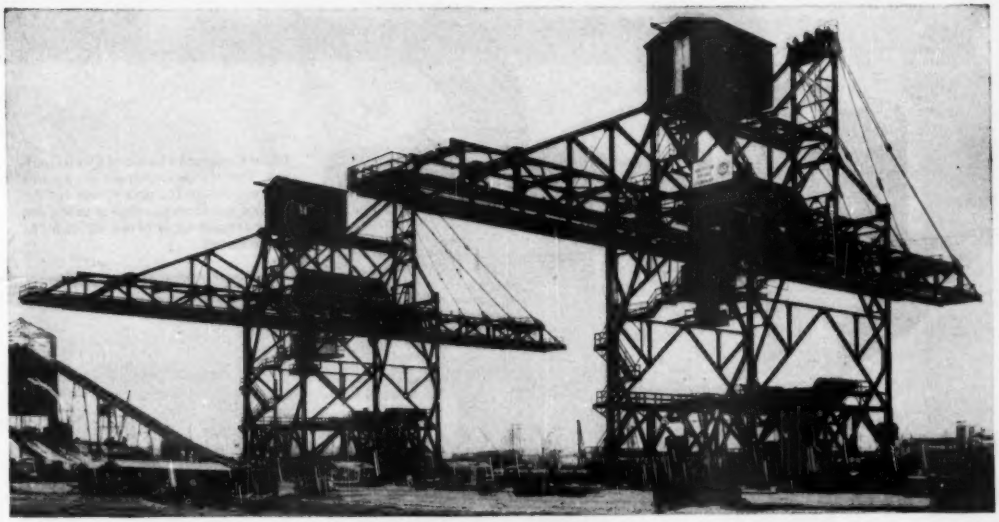
This brief outline of G-R Feedwater Heaters is explained in detail in bulletin which graphically describes the many important features that are obtainable only in G-R designs. If you will write us your requirements, a copy of this informative bulletin, together with recommendations for your particular plant requirements, will be sent without obligation.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

GR 232

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS



They unload 2000 tons an hour!

B & O giant unloaders first to use new G-E product

PUMPLESS RECTIFIERS

G-E *pumpless* rectifiers give lower cost d-c power than conventional pumped rectifiers because vacuum pumping system is eliminated. This means no vacuum headers, indicators or connections and no condensation pump.

The new Baltimore and Ohio ore facility at Baltimore reduces turn-around time for ore boats and speeds strategic iron ore on its way to the nation's steel-producing centers.

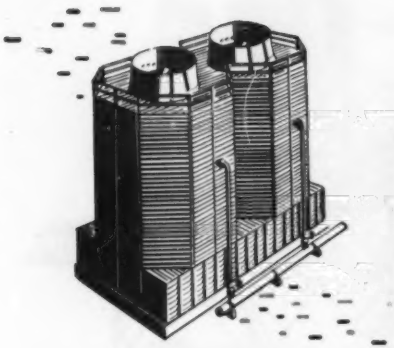
Mercury Arc Rectifiers coupled with adjustable d-c drives are important factors in the highly efficient unloading cycle. Two 1000 kw G-E *pumpless* rectifiers supply the d-c power.

These new G-E *pumpless* rectifiers give continuous low-cost service because they incorporate the latest improvements in design. Vacuum pumps usually required for rectifiers of this great a capacity are eliminated. So are the pumping losses and the water formerly needed to cool the vacuum pumps. All parts are easily accessible for periodic inspection, and any tank can be replaced by a stand-by spare, if necessary.

For information about modern *pumpless*-rectifier conversion to fit your d-c power needs, call or write your nearest G-E sales representative. General Electric Co., Schenectady 5, New York.

GENERAL ELECTRIC

324-5



FLUOR COUNTERFLO COOLING TOWERS offer many unique features — all worth looking into!

When selecting cooling towers, it pays to look into the structural and mechanical design features of a Fluor Counterflo Cooling Tower. It is here that the difference between one cooling tower and another is evident—where the difference in structural stability, maintenance of mechanical equipment, and quality appearance lies.

The illustration at right—accurate in every detail—is the way your Fluor Counterflo Cooling Tower will look with a portion of the exterior wall removed. Note the exclusives, the extras, that make Fluor Cooling Towers a wise buy. When *dependable* performance, *low* maintenance, and *quality* appearance is essential or desirable in your plant or process operations, look into a Fluor Counterflo Cooling Tower.

Fluor Counterflo Induced-Draft Cooling Towers incorporate many important design features which cut the cost of maintenance and improve the appearance of cooling equipment installations.

STACK and FAN ASSEMBLY

DRIFT ELIMINATORS

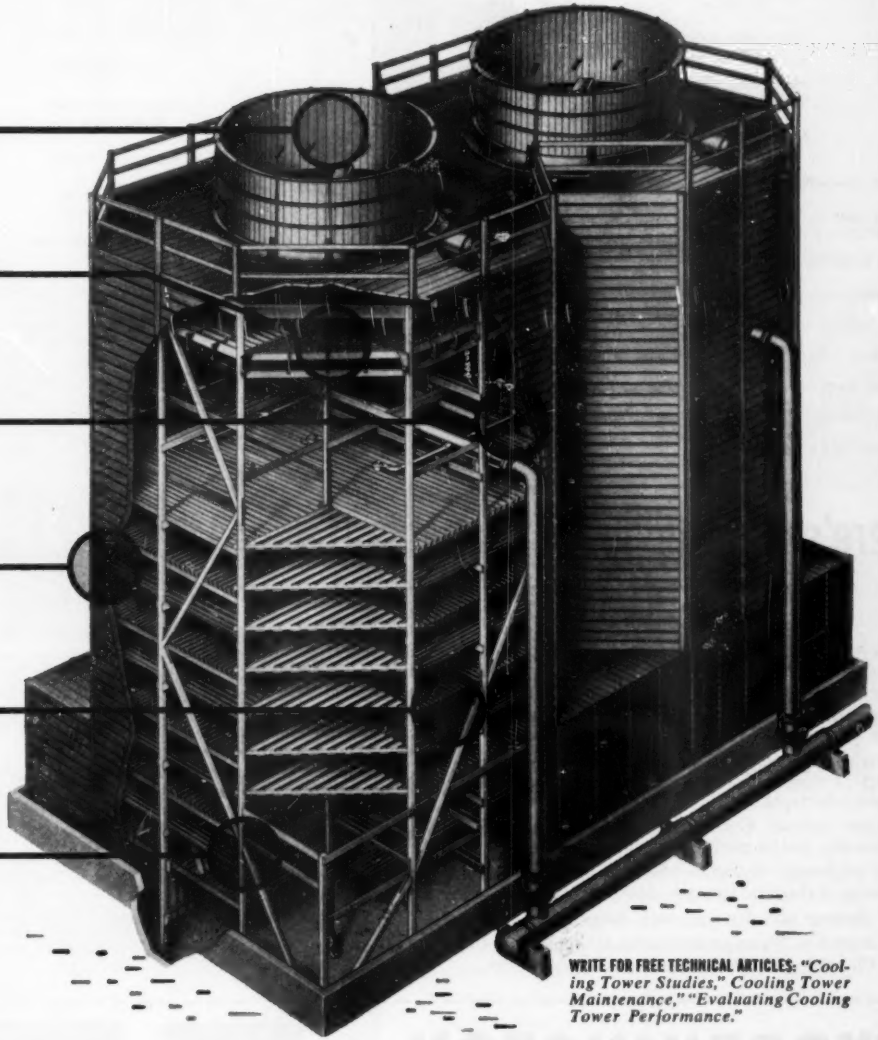
DISTRIBUTING SYSTEM

DOUBLE-WALL SHEATHING

GRID DECKS

TOWER STRUCTURE

BE SURE WITH **FLUOR**

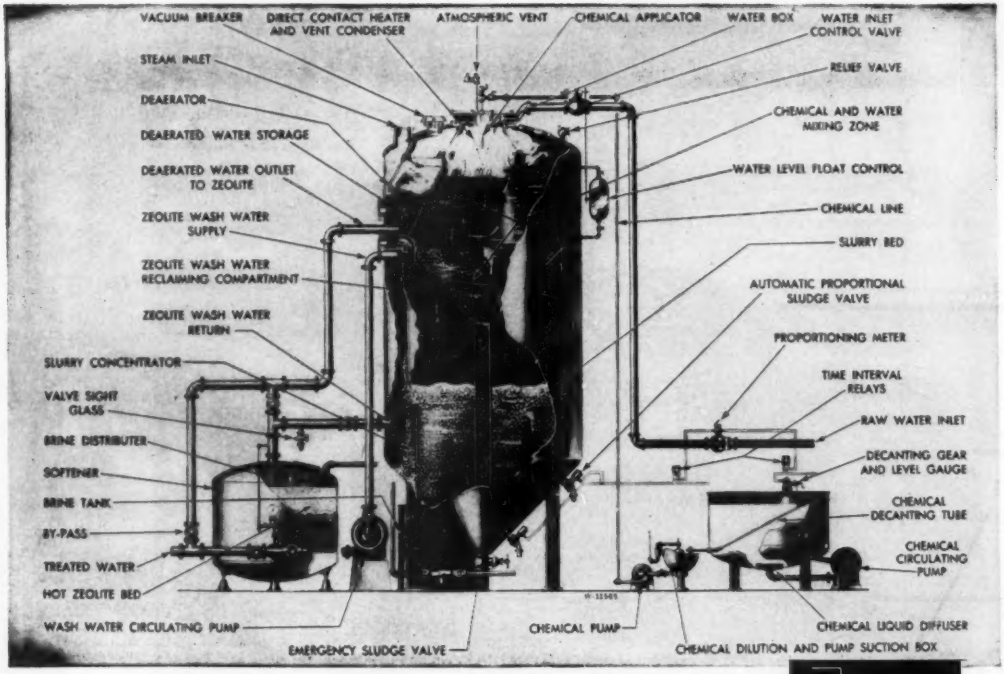


WRITE FOR FREE TECHNICAL ARTICLES: *"Cooling Tower Studies," Cooling Tower Maintenance," "Evaluating Cooling Tower Performance."*

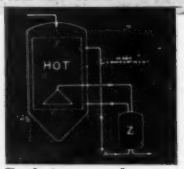
THE FLUOR CORPORATION, LTD., 2500 South Atlantic Boulevard, Los Angeles 22, California

New York, Chicago, Boston, Pittsburgh, Tulsa, Houston, San Francisco, Birmingham, Calgary.

REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.I., England



Here's how to make water softening a soft job for you



You have less to do . . . to worry about . . . to pay for—when you use Worthington's revolutionary Hot-Z Slurry-Type Deaerating Water Softener.

It combines all the best features of Hot Process and Zeolite, plus these Worthington-originated features:

No more scaling trouble. Direct-contact vent condenser eliminates scaling trouble experienced with old-fashioned shell-and-tube types.

Supervision reduced. Concentrated sludge is removed automatically and proportionately to water volume.

Assures uniformity. Hydraulic chemical mixer assures uniformity of chemical strength. Also saves space.

Easier cleaning of valve-type wash water sight glass.

Better deaeration. Steam-jet deaeration is simpler, gives better efficiency—removes oxygen to .005 cc per litre.

Independent backwash system. Built-in annular wash water compartment provides clear hot water for backwashing and reclaims it without affecting operating velocities in treating zone. This feature not only pays off in systems employing filters, but also is ideal for backwashing the hot zeolite.

You also save because Worthington Hot-Z Systems operate on low-priced lime and salt. The average installation saves enough in chemical costs to pay for itself in 3 years!

Get all the facts!

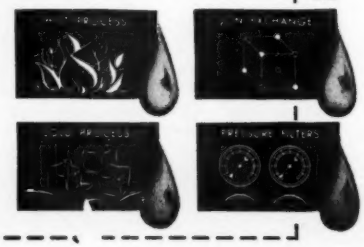
It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find *there's more worth in Worthington.* Worthington Pump and Machinery Corporation, Water Treating Section, Dunnellen, N. J.

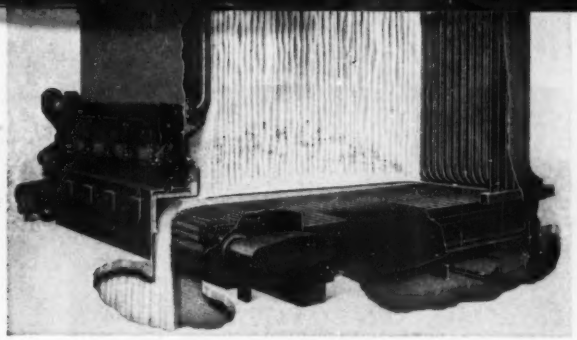
J.J.2

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems

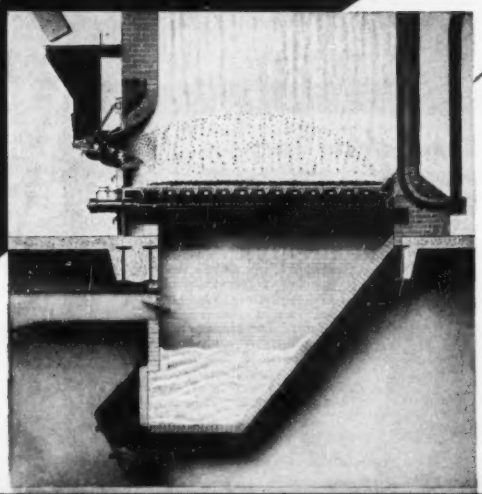




DETROIT ROTOGRATE STOKER—For greater economy in steam production, use the Detroit RotoGrate, the original spreader stoker with *forward moving, continuously cleaning grates* that discharge the ash at the front. The RotoGrate burns efficiently any Bituminous coal or Lignite—is readily adjusted to change from one fuel to another. It permits higher burning rates to produce *more capacity per foot of boiler furnace width,* thus holding down investment in both generating equipment and building.

DO YOU NEED MORE STEAM? If so, investigate and order your Detroit Stokers now. Whether you are an old or new customer, we are at your service.

Insure yourself



DETROIT ROTOSTOKER—A great coal saver, for small to medium size boilers. Available with stationary, Hand Dumping and Power Dumping grates. Unique design of Overthrow Rotors assures continuous and dependable fuel feed and uniform distribution in the furnace. Burns any type Bituminous coal or Lignite with high efficiency.

OTHER TYPES AND SIZES OF DETROIT STOKERS FOR EVERY INDUSTRIAL NEED

Write for bulletins, no obligation

DETROIT STOKERS

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities

Utilize the flexibility of

...for continuous and uninterrupted

Check this Flexibility

- √ *Variety of bridge circuits... Wheatstone, Kelvin, Impedance, resistance thermometer, thermocouple, etc.*
- √ *Variety of auxiliary switches for audible or visual alarms.*
- √ *Variety of chart speeds—½" to 120" per hour.*
- √ *Variety of printing speeds—1 to 30 seconds.*

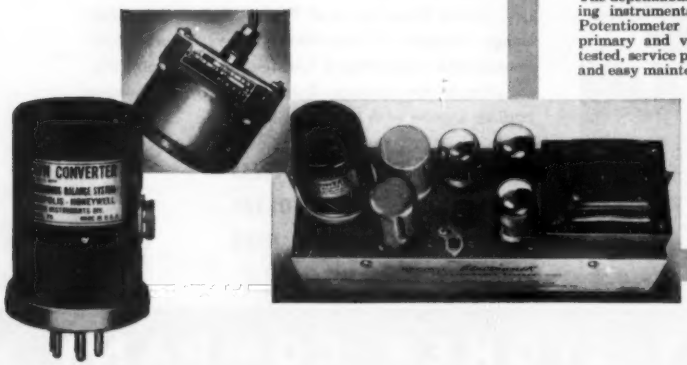
THE flexibility of the entire line of Brown instruments makes available a variety of combinations well qualified to meet the measuring, recording and signalling demands of any power plant. And the standardization and interchangeability of components simplify maintenance and stocking of parts.

Applicable to the measurement of temperature, pressure, flow, power, current, frequency, speed, pH and conductivity... such flexibility in measuring variables is easily obtained by changing the bridge circuit and primary sensing element.

Check the flexibility features... then call in our local engineering representative for a discussion of how they can add to your operating efficiency.

Dependability, Too!

The dependability you demand from your recording instruments is insured by the *ElectroniK* Potentiometer... by the dependability of its primary and vital components which are life-tested, service proven, and designed for minimum and easy maintenance. It takes little more than a glance to appreciate the ruggedness of the positive balancing motor, the hermetically-sealed converter, the simplified continuous balance amplifier... as well as the minimum of moving parts and the obvious freedom from adverse effect of dust and atmospheric moisture.



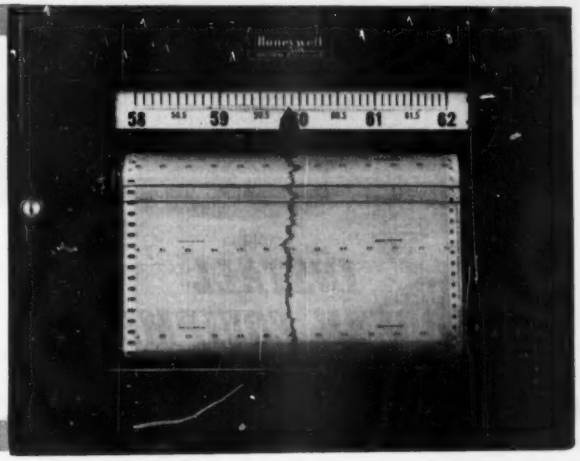
ElectroniK Potentiometers

frequency measurement...

THE *ElectroniK* FREQUENCY RECORDER

Important Features

- *Continuous Balance measuring system—with electronic non-cyclic balancing—not mechanical in operation.*
- *Frequency change as small as 0.01 cps initiates rebalancing action.*
- *Calibrated accuracy within 0.025 cps at normal frequency.*
- *Unit construction eliminates delicate mechanical linkages . . . assures long trouble-free operation with minimum of maintenance.*



THE *ElectroniK* Frequency Recorder is a *must* for central stations and systems offices. It provides an *uninterrupted* check on generator performance by its instantaneous measurement of frequency . . . furnishes accurate, permanent records . . . and makes load dispatching easier.

Operating on the electronic "continuous balance" principle, the recorder features unusual sensitivity and dependability. Its balancing motor and mechanism move only during a frequency change, thus reducing wear of parts to an absolute minimum. Its scale—12 inches wide—makes for easy readability at a distance, for checking the direction and amount of frequency deviation.

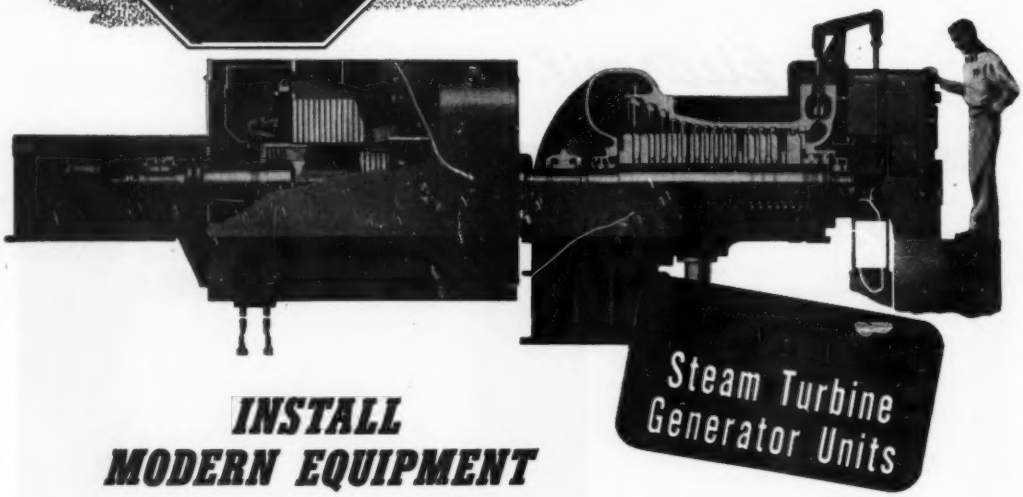
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

● *Important Reference Data*

For more detailed information, write for Data Sheet No. 9.1-8 . . . and new Catalog No. 90-2, "Supervisory Instruments for Power Generation."

END ..Generation Worries!



INSTALL MODERN EQUIPMENT

COMING DAYS of higher process steam and power demand will make power plant outages doubly hard to bear. Where will *you* be in this picture? Prepared with modern equipment to carry this severe load? Or just hoping for the best with outworn and outmoded equipment.

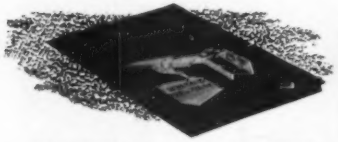
Truly modern WA-Series steam turbine generating units are already generating power and can be working for you sooner than you think. They are supplied in a wide range of NEMA ratings through 7500 kw, for either condensing or non-condensing service, with or without automatic extraction.

The accurate, reliable centrifugal type speed governor is the same kind used by Allis-Chalmers on its large steam and hydraulic turbines. The governing system incorporates oil pressure and if turbine system oil pressure should drop for any reason, the main throttle and inlet valves will close immediately, safeguarding the unit.

And just as in the larger Allis-Chalmers steam turbines ranging to 150,000 kw, trouble-free labyrinth steam seals are used for glands and interstage packing. Gland casings, moreover, are removable without disturbing the turbine casing.

These modern generating units are functionally attractive and completely coordinated in design. Impulse turbine, housing type air-cooled generator, and exciter are designed, manufactured, assembled, and tested under one supervision at one plant.

Get the *full* story on the quality features in the modern WA-Series! Be sure *your* next generating unit is up to date. Call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3530



BULLETIN NOW AVAILABLE!
Ask for WA-Series Bulletin 03B7654

ALLIS-CHALMERS

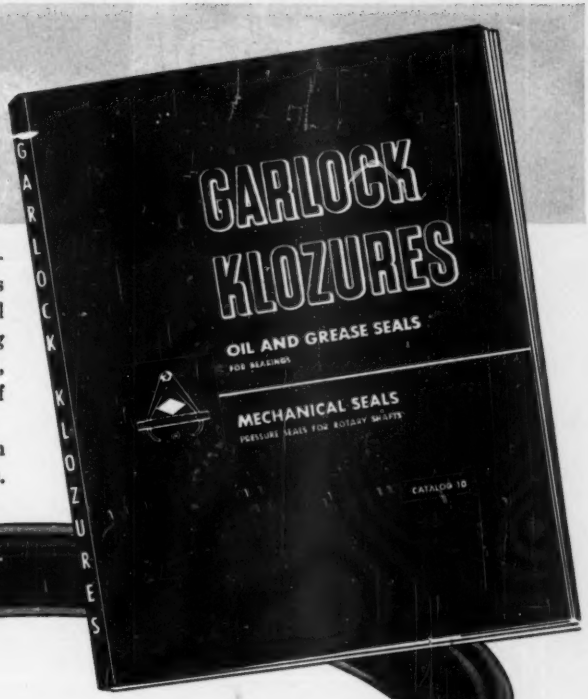
TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

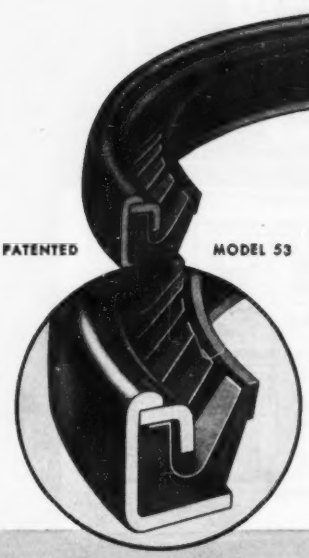
World's Widest Range of Power Plant Equipment

WRITE FOR YOUR COPY!

This new handy catalog describes our *complete* line of KLOZURE Oil and Grease Seals for bearings. It contains illustrations of all the types of KLOZURE Oil Seals—including many new designs for bearing protection, typical applications, and a complete list of sizes and part numbers.

In addition, this catalog also describes in detail Mechanical Seals for rotary shafts.





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GARLOCK Klozure* OIL SEAL

*Reg. U. S. Pat. Off.

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THE GARLOCK PACKING CO.
PALMYRA, N. Y.

Please send me a copy of the new Garlock KLOZURE Catalog No. 10

Name .....

Title .....

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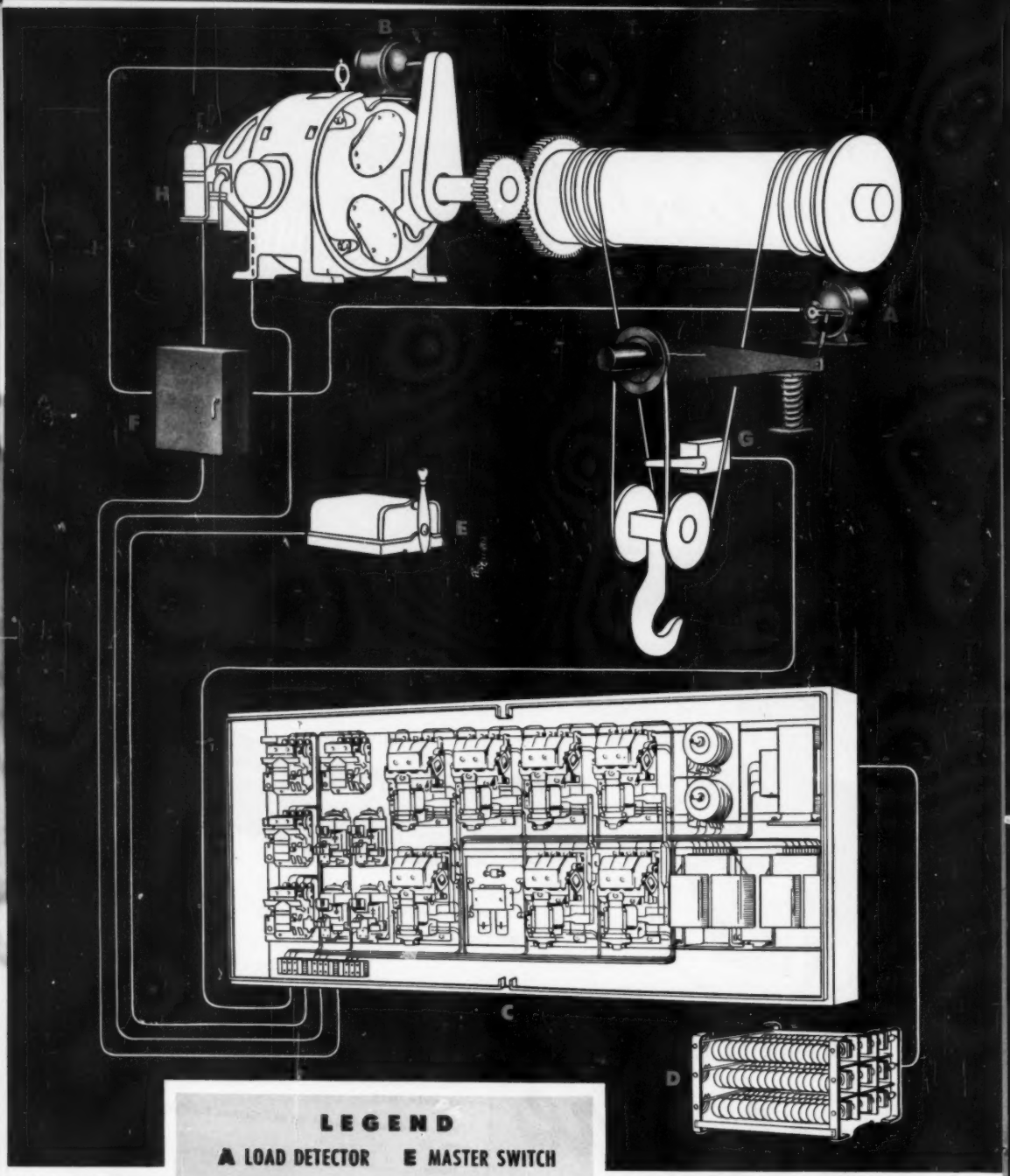

LEGEND

A LOAD DETECTOR	**E** MASTER SWITCH
B PILOT GENERATOR	**F** DYNAMIC BRAKING UNIT
C MAGNETIC CONTROLLER	**G** LIMIT SWITCH
D RESISTOR	**H** HOLDING BRAKE

NEW LOAD-O-MATIC

A-C CRANE HOIST CONTROL

Here's the new Westinghouse Load-O-Matic Crane Hoist Control that divorces torque from speed and permits the co-ordination of speed and load to suit the requirements of each particular installation.

Key is the Automatic Load Detector shown on the schematic drawing at the left. This mechanism measures the weight of the load suspended on the hook and, through the medium of the main circuit, uses this intelligence to control the power delivered to the hoist motor. Thus, motor torque depends primarily on hook load.

This means—*precise crane performance.* Loads can be accurately spotted without the necessity of jogging or inching. Operator can actually float the load into the desired spot. Overshooting is eliminated. Crane operation can be delegated to semi-skilled operators.

Load-O-Matic offers you these exclusive features:

SLOWER STABILIZED CREEPING SPEED throughout the load range than for any other a-c system.

DECREASE IN SPEED WITH INCREASE OF LOAD on first two points, hoist and lower—safer and surer handling.

MINIMUM MOTOR SIZE for a given crane—less motor input current is required than for any other electrical braking system.

DYNAMIC BRAKING to prevent dropping of load in case of power or brake failure.

LOAD DETECTOR PREVENTS LIFTING EXCESSIVE LOADS by operating signal or by shutting off power.

LONGER CONTACTOR LIFE—saturable reactor excitation gives speed control for positioning . . . fewer contactor operations.

J-27014

SEND FOR FREE BOOK. Complete details of the new Westinghouse Load-O-Matic A-C Crane Hoist Control are contained in this booklet. Send for your free copy today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S

Westinghouse

CRANE CONTROLS

WORTHINGTON

POINTERS ON PUMPS

Prepared for Industry by Worthington Pump and Machinery Corporation

A Plan That Gets the Most out of Centrifugal Pumps

Easy-To-Install Maintenance Program Means Better Performance, Longer Life

You can't get maximum production when your equipment's operation is constantly interrupted due to breakdowns. Moreover, today's equipment shortages make it increasingly more important that you get all the life you can out of your present machines.

We'd like to suggest a maintenance plan that will help you get the most out of one of your most vital pieces of equipment—centrifugal pumps.

Keep Informative Records

If you haven't already done so, it's a good idea to begin your maintenance plan by setting up a card index file so that you can catalogue each pump in your plant. Each card should contain the following information: plant pump number, size, manufacturer's name and style, serial number, date installed, and any other data which will help you to rapidly locate repair parts lists and manufacturer's parts numbers.

The rest of the card can be divided into a number of columns: Repair Date, Part Affected, Remarks, and Cost. A typical card is shown here.

PUMP MAINTENANCE CARD

_____PUMP NO.	_____MANUFACTURER
_____SIZE	_____MFGR'S ADDRESS
_____DATE INSTALLED	_____MFGR'S SERIAL NO.
_____LOCATION	_____MFGR'S STYLE

DATE	PART	REMARKS	COST

If you're careful to enter every maintenance or repair operation on the proper card, it won't be long before each card indicates a particular pattern of maintenance.

Set Up A Maintenance Schedule

Once this pattern is established for all the cards, you can set up a schedule of maintenance points for such items as: packing, greasing or oiling, painting, gasket replacement, and bearing examination. You may find, for example, that a unit or group requires packing maintenance about once every three months, and greasing once every four to six months, etc.

Your next step is to arrange a plant schedule so that a particular pump may be shut down for maintenance at or before these times. Thus you make it possible to do the maintenance work under proper and unhurried conditions to assure maximum conformity of production consistent with long pump life. In addition, examination of the card catalogue will guide operating and maintenance personnel as to quantity of repair parts they should keep on hand.

Make Periodic Inspections Externally

It is considered *inadvisable* to open pumps for inspection.

Rather, recent practice is to let pumps stay on the line until such time as external symptoms indicate overhaul may be required. These symptoms involve either a reduction in effective capacity because of wear at the internal clearance points or mechanical difficulties, such as vibration or noisy operation.

Parts requiring most frequent replacement in centrifugal pumps are: wearing rings, shaft sleeves, packing and bearings.

The most important maintenance point on process pumping equipment is the stuffing box. It must be kept clean, cool, and lubricated—but *packing* is the crucial operation. A good packing method will be discussed in a later edition of *Pointers on Pumps*.

Don't forget the frames, base plates, and supporting parts of your pumps. Good housekeeping often makes it easier to do a good overall maintenance job!

Can We Help You?

Worthington makes more *standard* pumps than any other manufacturer. Don't buy a "special" (at a higher price) without checking to see if Worthington makes it *standard*.

If you *do* need a special, remember Worthington's modern engineering facilities, backed by the longest and broadest experience in the field. Contact our nearest District Office or write to Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.

C.2.2

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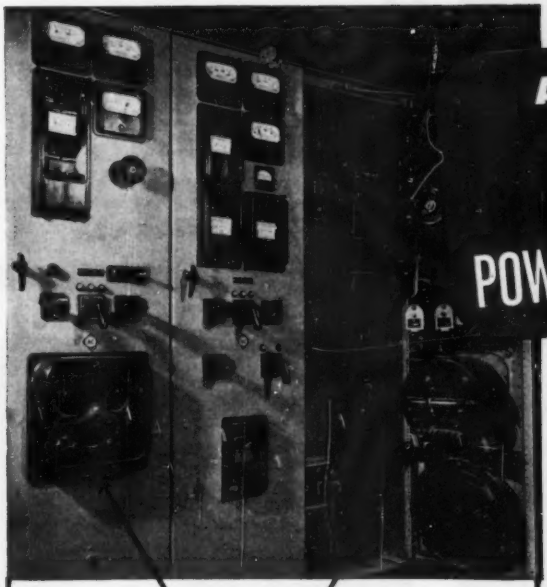
Centrifugal Pumps

HOLDS VOLTAGE within ½ of 1%



ALLIS-CHALMERS POWER PLANT CONTROL

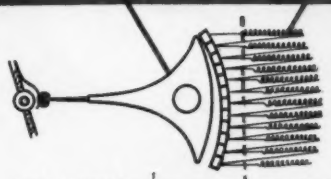
YEAR AFTER YEAR, regardless of line or load disturbances, proper voltage is accurately maintained. This is the kind of performance you can expect from *Rocking Contact* Voltage Regulators . . . it is the kind of performance users are getting!

"Regulation is tops!" says one user. "Put in service ten years ago and still no sign of needed maintenance," says another. "Not one penny for maintenance in fifteen years of continuous service," says still another.

And there is a reason for this trouble-free performance. *Rocking Contact* Voltage Regulators are precision built . . . require no delicate adjustments. *Rocking Contact* sectors are supported in jeweled bearings, rock on carefully machined commutator segments heavily plated with silver. Just a slight *rocking* motion regulates voltage by varying resistance in the exciter shunt field circuit. Response is fast . . . regulation accurate to within ½ of 1%.

Rocking Contact Regulators stay accurate . . . operate for years without repair or maintenance. Call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for more information.

A-3269



Sealed, dust-tight front portion of regulator housing contains *Rocking Contact* sector pivoted in jeweled bearings. The smooth working, hard graphite sector face rocks on a curved silver surfaced commutator . . . regulates with slight movement . . . reduces wear.

Ventilated rear section contains resistance elements. Each resistance element is wire wound, accurately designed according to the characteristics of your generating equipment. They are connected to the commutator segments within the dust-tight front section.

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A-C ALLIS-CHALMERS

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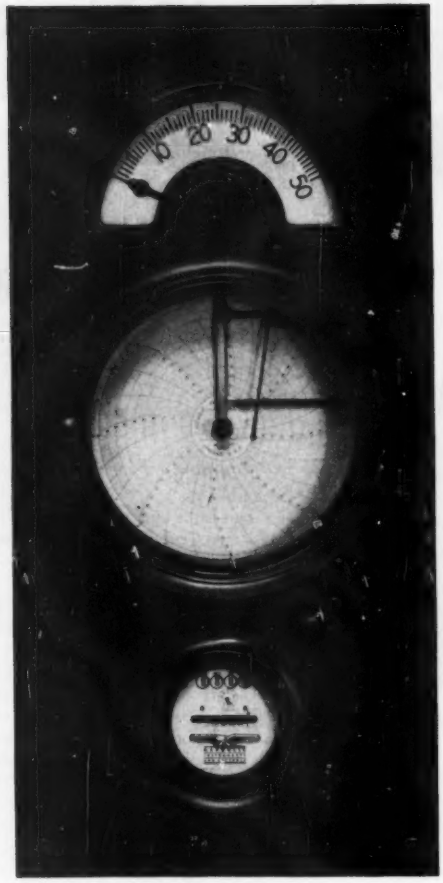
ROTATING GENERATOR VOLTAGE REGULATOR

REGULEX Generator Voltage Regulators are recommended for use with large generators where field forcing and extremely fast response are required. High amplification of small changes produces immediate, strong corrective action. Similar to a dc generator in construction, it has nothing to get out of adjustment . . . replaces pilot exciter.

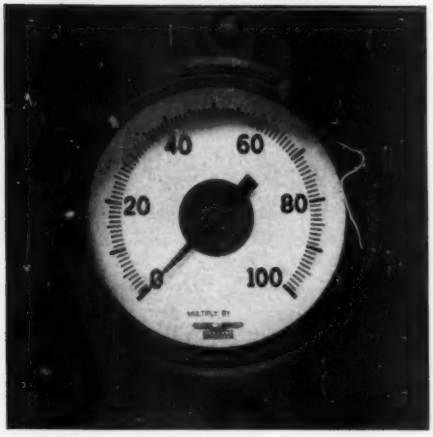
AUTOMATIC SYNCHRONIZER FOR ROTATING MACHINERY

The SYNCHRO-OPERATOR automatically brings the speed of synchronous condensers, alternators and frequency changers to synchronism. While doing so, it indicates relative speed, which machine is faster, phase angle between machines, and the exact point of synchronism. Breaker is automatically closed at the exact point of synchronism. Send for leaflet 14563868.

Varying flows because the



Indicator-Recorder-Integrator



Indicator

The Republic flow integrator, being of the modified watt-hour type, totalizes continuously —not intermittently. It operates independently of the recorder and its accuracy is not dependent on or affected by any clock mechanism or mechanical action.

The Republic meter is, on this account, peculiarly fitted to follow all changes in flow rate and accurately measure highly fluctuating flows.

ALL TYPES OF FLUIDS

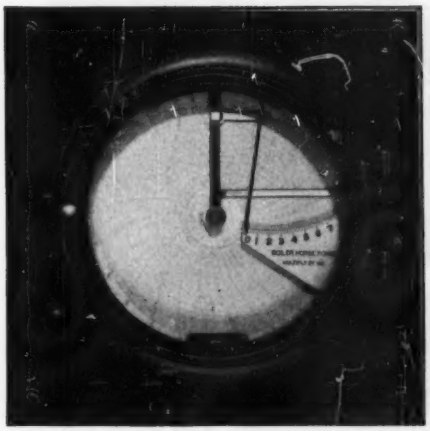
Republic electric type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 5,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator—are of the remote reading type and can be located any distance from the point of flow measurement.

ANY COMBINATION

While each Republic reading instrument is standard in design and construction each is especially calibrated for the particular flow measurement for which it is specified. Any reading instrument, indicator, recorder or integrator, may be obtained separately or in any

are accurately totalized

integrator is continuous



Recorder

Integrator

combination desired, making possible the highest degree of flexibility in plant use.

SIMPLE IN OPERATION

The Republic electric meter is the only flow meter commercially manufactured which is strictly electric in its operation. All other types of so called electric meters use the motion of the mercury to move a float or produce a force which is then converted into an electrical value which is in turn transmitted to a receiving or reading instrument. In the Republic meter, the transmitted electrical value is determined directly by the mercury motion, thus eliminating one of the steps in the sequence, and simplifying the mechanism to that extent. Their are no floats, levers, cams, rotating shafts or anything else to interfere with the unimpeded movement of the mercury, which has no work to perform, but merely fulfills the function of making contact.

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THE WORLD'S GREATEST power exhibit is America, leading all nations in installed electrical generating capacity and in delivered electrical energy—also in all other forms of power: steam for process and heating, refrigeration, conditioned air, compressed air, pumped water.

It's no mere coincidence that this record-breaking application of every form of fluid energy goes hand in hand with the world's highest standard of living. Rather, it's a simple matter of cause and effect. Power makes goods: the more power the more goods produced.

Many factors have combined to bring America to this leading place as a generator and user of fluid energy in all its forms:

1. The American traditions of freedom, initiative and private enterprise.

2. A population whose ancestors dared to cross oceans to win a new way of life.

3. A land of vast area, well stocked with coal, oil, gas, iron ore and other raw materials needed for the production of power and for the conversion of this power into commodities.

4. Thousands of engineers who love and understand the machines that produce and apply power.

5. The world's greatest network of technical schools, books and periodicals—an unparalleled mechanism for the sharing of technical skills and the propagation of useful knowledge.

6. The world's most progressive industrial leaders, eager to bring more power to the hand of every worker and to produce this power economically with up-to-date equipment.

7. A power-equipment manufacturing industry that leads the world in size and rate of progress—in its pioneering spirit, its practical inventiveness and its will to achieve.

8. An enlightened business philosophy that sparks the whole process—stimulating Americans to demand more of the good things of life—building their ambition to produce more in order to earn more—inspiring manufacturers of productive equipment to promote their goods vigorously in a competitive market; causing users of such equipment to buy intelligently to increase production and cut costs.

To sum up, America is a gigantic mutual-benefit society, powered by unprecedented supplies of fluid energy and directed by the inner fires of ambition in an atmosphere of freedom and teamwork.

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Pioneered by Edward—developed after years of extensive flow tests and experiments with plastic models, prototypes, and much specially designed equipment in the largest laboratory in the world devoted exclusively to steel valve research—Edward *Streamlined Flow* offers these four outstanding advantages.

1. Reduces wear-producing turbulence—giving longer life to seat, disk, and other moving parts.
2. Lower pressure drop.
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Edward ...BIRTHPLACE OF BETTER VALVE DESIGNS

—IN A FULL RANGE OF VALVE SIZES

These illustrations show wear-reducing Edward streamlined flow in both small and large valves. Small valve demonstrates straight through, full flow channel of Edward Univalve. Large valve is Edward globe stop valve . . . note smooth, economical flow pattern.

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That's why it pays to specify Edward Valves

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THIS *"Life Line"* FORETELLS GOOD FORTUNE FOR YOUR PIPING

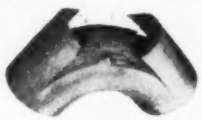
Every cost sheet today confirms the fact that the most expensive material you can use is that which must be replaced too soon . . . and too often. Premature pipe failure digs deep into your profit pocketbook—directly, through repair or replacements; indirectly, through production tie-ups and disrupted routine.

Users by the thousands have found the answer to lower maintenance in Byers Wrought Iron pipe. They have come to recognize its *red spiral stripe* as a dependable "life line" for predicting future service. They know that when corrosion is a threat to durability, Byers Wrought Iron pipe lives up to the prediction and pays-off in long, trouble-free service.

This time-tested material has rolled up impressive service records in a wide variety of applications. It is serving in thousands of snow-melting systems, of all sizes. Its mechanical strength and proved corrosion resistance make it the first choice for radiant heating systems. In steam and return lines, Byers Wrought Iron pipe has been remarkably effective in eliminating excessive repairs. It has successfully combated corrosive hazards in condenser services, air conditioning systems, underground lines, and sewage disposal plants. Many more services could be added to this list . . . but these will serve to suggest genuine wrought iron's many possibilities.

The next time you approve or specify pipe, investigate the superior performance of genuine wrought iron. You'll find it profitable to do so. For more facts on this time-tested material, write for our bulletin, THE ABC's OF WROUGHT IRON.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.



WHY GENUINE WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

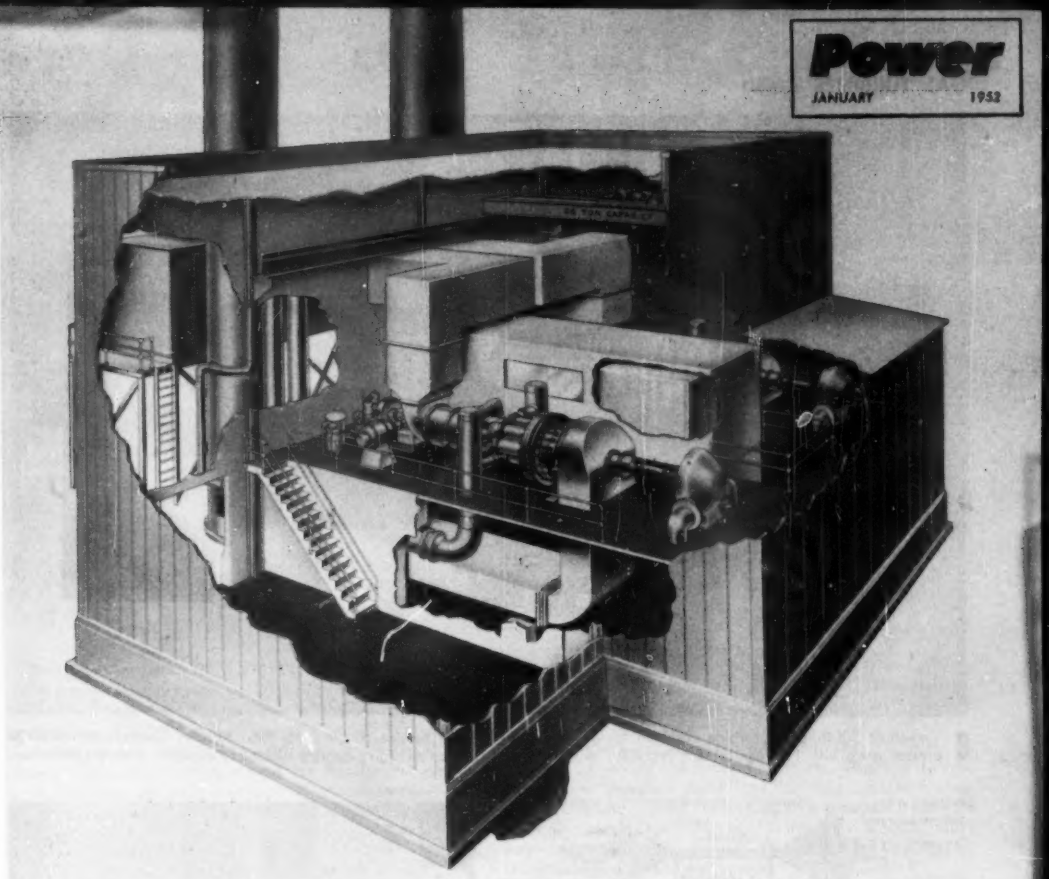
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



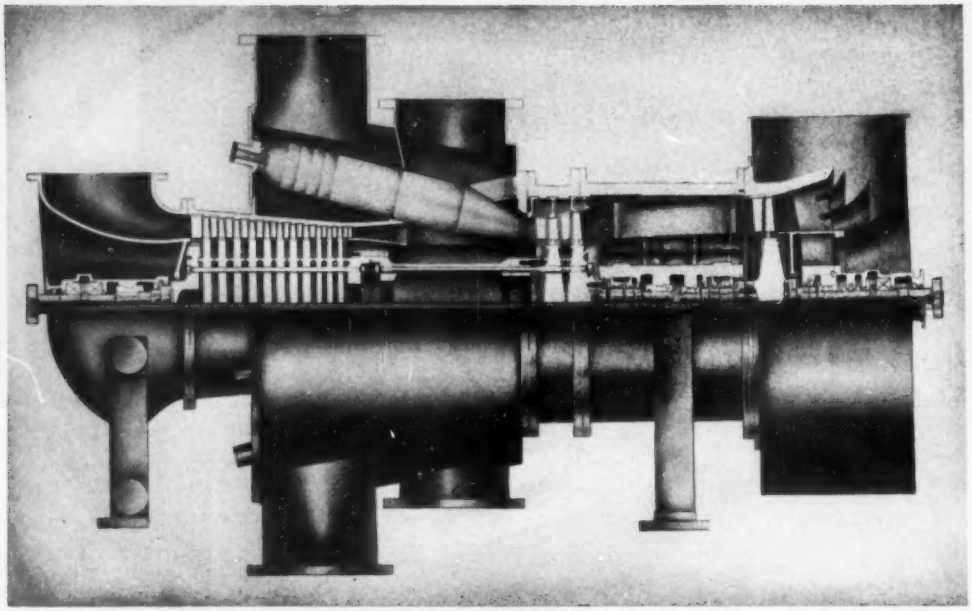
1 HERE'S HOW 2-unit gas-line compressor station may be laid out when driven by 5000-hp gas turbines. Compressors take in air through evaporative precoolers and washers. Turbines discharge through outdoor regenerators supporting the steel stacks

2 CONTRASTING with stationary plant above, here's portable hand-started 47-hp gas-turbine unit for pumping water. Burning diesel fuel, unit delivers 500 gpm water at 100 psig. High fuel rate of unit points to uses of emergency, standby nature

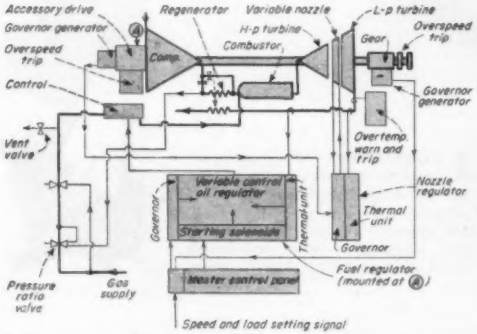
Horizons Unlimited for Gas Turbines?

Remember the predictions that gas turbines would be suitable only for limited-size ranges and narrow application fields? Present-day activity shows that many gas-turbine researchers don't put much stock in these forecasts. Here are highlights of what is going on now

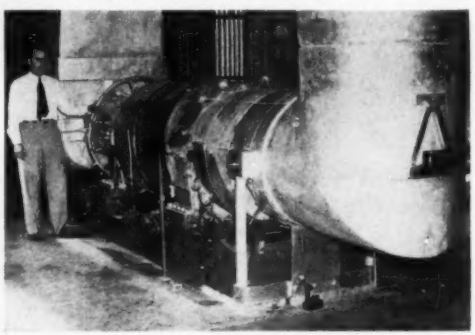
► RECENT ANNOUNCEMENTS as well as papers before professional societies show determined efforts to apply gas-turbine plants to a wide variety of power needs. Experimental gas turbines have crossed the ocean, driven a passenger car, powered a truck, flown aircraft, liquefied air, and done other chores. Commercial gas turbines have buckled down to practical jobs of driving central-station generators, powering railroad locomotives, turning gas-transmission-line compressors, supplying compressed air to oil and steel-making processes, supercharging oil-burning reciprocating engines, pressurizing velox boiler furnaces, actuating aircraft re-



3 Two-shaft 5000-hp gas turbine designed for gas-line compressor drive has 11-stage axial compressor driven by 2-stage turbine, single-stage load turbine. Compressor discharge passes through extended-surface regenerator, then 6 combustors



4 Control diagram, for units shown in Fig. 1, makes station completely automatic. Remote control possible in future



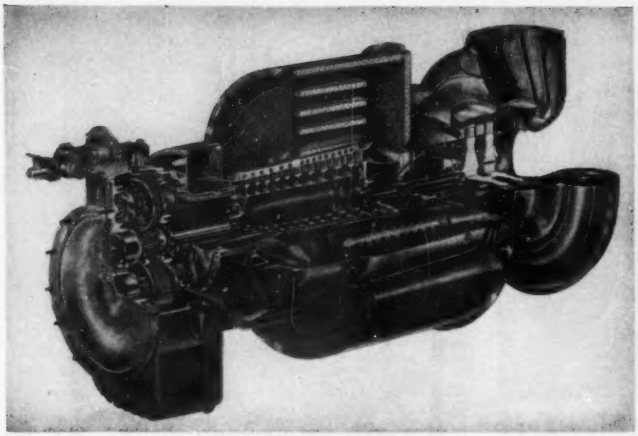
5 First 1800-hp gas-turbine drive unit for gas-line compressor (located on other side of fire wall) has single shaft

frigerating systems, pumping water, running jet engines, and probably other jobs not yet announced. Gas-turbine application will be limited more by economics, it seems, rather than technical ability to do a given job.

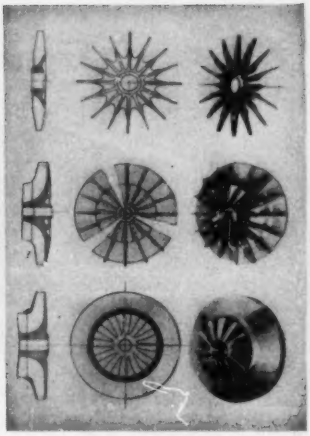
Many studies and research projects under way plan to make the gas-turbine plant a versatile fuel user. Natural gas has proven to be an ideal fuel, distillate oils can be readily burned, residual oils may be used—sometimes needing additives or treatment, pulverized coal looks promising, peat is under investigation, and even wood may prove commercially feasible. Gas producers as a means of making coal available as a fuel are also under investigation.

GAS PIPELINE PUMPING

About 3,500,000 compressor hp serves the nation's main gas-transmission pipelines, totaling up to 100,000 miles. Conservative estimates show the installed compressor horsepower will ultimately be more than doubled as gas discoveries and demand grow. In the past most compressors were reciprocating type driven by gas-fired reciprocating engines. At end of the last war centrifugal compressors driven by electric motors on the converted Big and Little Inch pipelines proved successful. Gas-fired gas turbines make an ideal prime mover for this type of compressor.



6 Single-shaft 250-kw gas-turbine unit for shipboard emergency generator drive burns diesel fuel, has screened air-inlet silencer ahead of axial compressor



7 Compressor impellers like these may also run as radial-inflow turbines

First Gas-Line Unit. In May 1949, Westinghouse Electric Corp placed an experimental 1800-hp gas turbine in service driving an Ingersoll-Rand direct-connected centrifugal gas compressor. This test station was at Wilmar, Ark., Fig. 5. The unit ran here until fall of 1950, when a paralleled high-pressure line eliminated the need for this booster station.

In Jan 1951, the unit went into its present service, near Farmington, Mo., of "packing" an underground storage field. The gas-turbine drive has shown advantages of (1) light foundation needs (2) small station housing (3) few auxiliaries (4) low auxiliary-power demand (5) low lubricating-oil consumption (6) no water needs (7) simple piping to and from station (8) no gas-line pressure pulsations (9) ready adaptation to automatic operation. Unit can be shut down for long periods without requiring special protection. Restarting can be done in very short time without difficulty.

Westinghouse is now building a 5000-hp 2-shaft gas turbine with regenerator, Fig. 3. Compressor-drive turbine speed is 6200 rpm, and the load turbine, 6500 rpm at nominal full-load rating. An extended surface regenerator recovers about 75% of available heat in exhaust gas. Shop testing is expected early this year. For more detail see "The Gas Turbine's Contribution to Gas Pipeline Pumping," by T J Putz, ASME Paper No. 51-A-102.

Another type of 5000-hp pipeline compressor drive under construction by the General Electric Co is shown in Fig. 1. This unit is intermediate between the 3500-kw and 5000-kw units built by GE. It can be used with or without a regenerator and has a 2-shaft arrangement. With heat recovery, thermal efficiency at output coupling will be 22.5% based on fuel higher heating value.

Adjustable Nozzles. Effective flow area of the output turbine nozzles can be varied by rotating the nozzle vanes about radial axes. This arrangement (1) reduces overspeeding on loss of load to about half by tripping nozzles wide open (2) gives better part load efficiency (3) raises capability at high ambients (4) allows taking substantial amounts of auxiliary power from gas generator shaft (5) reduces starting power (6) lets unit run at no load without load turbine exceeding rated speed and without running at too high exhaust temperatures.

Both turbine wheels are cooled by air bled from the compressor and introduced at the wheel hubs. Six combustion chambers designed for gas burning can be easily adapted to oil fuel.

Regenerators. Setting regenerators outdoors (1) saves on building height (2) reduces foundation height (3) minimizes heat rejection inside the building. Stack sits on regenerator and carries exhaust up to a point that prevents recirculation regardless of wind direction. Vertical tubes may collect less soot deposit from exhaust. Regenerator insulation must be weatherproof.

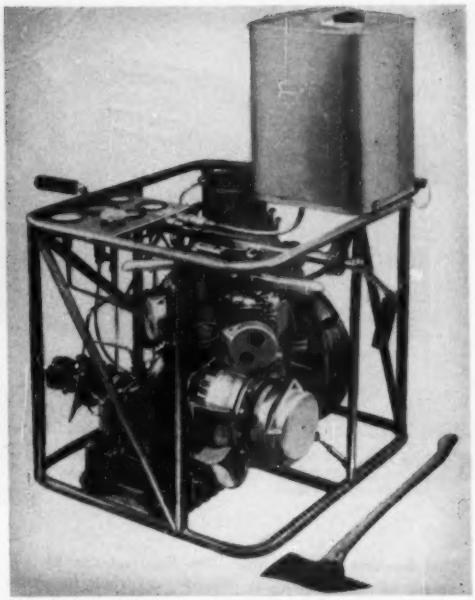
Regenerator has 46,000 sq ft surface returning 80% of available exhaust heat to the cycle. Exhaust flows inside tubes and compressed air outside. Total pressure drop through regenerator equals 5% of absolute pressure.

Controls. Fig. 4 shows the control system for the GE unit. Master control panel holds signaling devices and relays for cranking the unit, firing it and bringing it up to speed. Operating sequence can be controlled manually or automatically. Abnormal conditions—like (1) failure to fire (2) no battery voltage (3) no voltage on lube pump motor —will automatically shut down the machine during starting sequence. Misoperations—like (1) loss of flame (2) high wheel-space temperature (3) low lube-oil pressure — will shut down the unit while under load. An annunciator sounds warning and indicates abnormal conditions like (1) high bearing temperature (2) failure of vibration recorder amplifier (3) auxiliary cooling-water pump not running. The annunciator also indicates cause of automatic shutdown. For more details see "Design Features of a 5000-Hp Gas Turbine," by B O Buckland and D C Berkey, ASME Paper No. 51-A-113 available at 29 West 39th St, New York 18, N.Y.

CENTRAL STATION UNITS

First commercial gas-turbine installation at Belle Isle Station of the Oklahoma Gas and Electric Co continues to give good performance. This 3500-kw simple-cycle unit burning natural gas has run since July 1949 with about 18,000 running hours accumulated. A similar unit burning oil is installed at Farmingdale Station of Central Maine Power Co. This unit stands by for hydroelectric serv-

8 This 68,000-lb gross weight truck-trailer has been driven over 15,000 miles by 175-hp 2-shaft gas turbine, at front



9 Closeup of unit in Fig. 2; weighs 165 lb and may be started by one man. Pump *in foreground;* turbine, combustor, *rear*

ice and has not seen many operating hours because of ample water flow.

Bangor Hydroelectric Co has a high-efficiency 5000-kw unit running in its Graham Station with a second unit under installation. These units will carry base load during the day and go off the line at night and during weekends when hydro supply is enough to satisfy the load. These units burn specially treated residual oil fuel.

Public Service Co of Oklahoma has a similar high-efficiency 5000-kw gas turbine operating in its Elk City plant. This unit burns natural gas. A second unit is on order. All the above units are GE make. PS of Okla. also has on order a Westinghouse 15,000-kw high-efficiency gas turbine—largest so far in the U.S. The prime mover will drive a hydrogen-cooled generator. This 2-shaft plant will have the h-p turbine driving the generator and h-p compressor. The l-p turbine drives the l-p compressor. The unit uses intercooling and heat recovery. Unit is scheduled for delivery in 1954.

Central Vermont Public Service Corp has had one GE 6000-kw high-efficiency unit running in its Rutland plant since the summer of 1951, a second one under construction, with a third under consideration that will have a regenerator with about 10% more effectiveness than the first two. The plant will ultimately house four units. The first three units are nominal 5000-kw units with 6000-kw generators. This output will be attainable at summer ambients in Vermont. These units will run on base-load schedule in parallel with hydro stations of other companies.

Four GE 5000-kw units will be installed during 1953 by the Connecticut Electric Light and Power Co. They will be used for emergency standby service, as well as to help carry system peak loads. They expect to bring these units from cold standstill to full load within 15 minutes.

AUXILIARY UNIT DRIVES

Fig. 6 shows a section through a Solar Aircraft Co single-shaft 250-kw gas turbine for shipboard emergency generator drive. Low weight and minimum space needs make this an ideal unit for this type service. The small number of parts in the unit simplifies maintenance time and stocking. The unit was delivered for installation in Feb 1951.

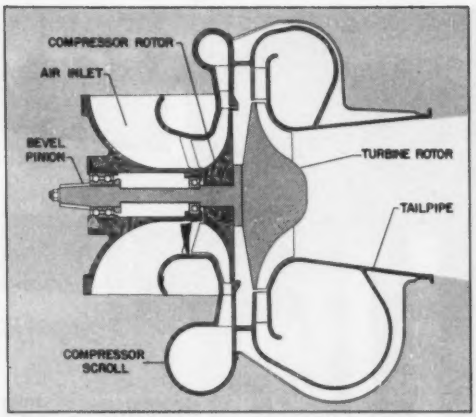
Design pressure ratio of 4.8, maximum gas temperature of 1540 F represent a compromise between cycle efficiency, life of turbine components and plant size. The unit runs at rated speed of 20,138 rpm.

Pressure drops, through inlet silencer and exhaust muffler of about 4 and 8 in. of water respectively, cause a loss of about 20 hp in engine output. The inlet silencer reduces inlet noises by about 10 to 12 decibels to an average of 97 decibels. Exhaust muffler reduces stack noise at outlet from about 100 down to 95 decibels.

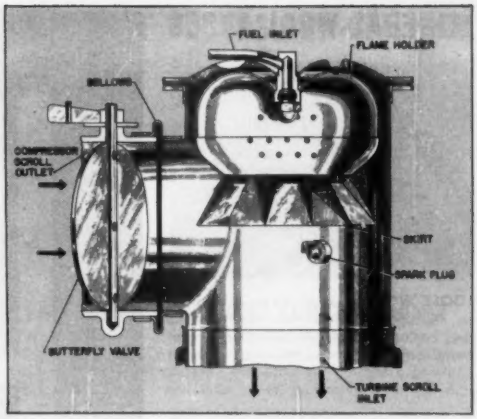
Starting time from initiating signal to full speed is about 17 *seconds.* This could probably be reduced by bleeding off compressor air, or installing a bypass around the first turbine stage. Complications from such changes do not seem worthwhile.

Shafts of reduction gear, compressor and turbine connect through splined couplings. Inlet air enters through the combination silencer and oil cooler at center of the engine. It makes a 180-deg turn to enter the compressor. Leaving the compressor it diffuses and again turns 180 deg to enter the single combustion chamber. Hot gas from the combustor enters the turbine scroll for distribution to the first-stage nozzles. The gases diffuse, leaving the last-stage blading to turn upward through the stack and muffler, not shown. Reversing air flow twice causes significant pressure loss but reduces plant length by a valuable 15%. Accessories mounted on the gear box include governor, lubricating-oil pump, fuel pump, speed sequencing switch assembly and tachometer generator.

This unit in its present form can be used to drive pumps, compressors, blowers as well as generators. Adding a third stage to the turbine on a separate wheel would make this unit suitable for vehicle and small-boat propulsion and other variable-speed applications. The unit will operate at improved



10 Radial-inflow turbine, of Fig. 9, drives centrifugal compressor on common shaft, and the pump through bevel gear



11 Elbow combustion chamber, of Fig. 9, burns diesel fuel entering through 8.3 gphr spray nozzle; spark plug starts

efficiency with such a third stage added. For more details see "Design Features of a 250-Kw Engine for Driving Shipboard Emergency Generator," by R R Peterson and P G Carlson, ASME Paper No. 51-A-105.

Pump Drive. Another Solar Aircraft Co development is the small gas-turbine-driven pump, Fig. 2, 9, 10, 11. This 47-hp unit is *hand started*, burns diesel fuel and was designed to suit the 4500-rpm pump speed. The unit features a radial inflow turbine and centrifugal compressor with the impellers of both mounted adjacent to each other on a common shaft.

To conserve space a modified elbow-type combustion chamber was selected. The 40,300-rpm unit drives the fire pump through a bevel gear, shafts of driver and pump being at right angles to each other. Average turbine inlet temperature runs around 1140 F, pressure ratio at 2.44, specific fuel consumption 2.22 lb per hphr. The pump delivers 500 gpm at 100 psig at its rated speed of 4500 rpm.

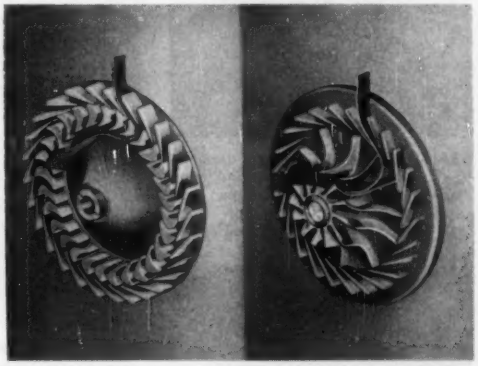
FREIGHT TRUCK DRIVE

Fig. 8 shows a 175-hp Boeing Airplane Co gas turbine and the 10-ton truck and trailer it has driven for over 15,000 miles in road trials. For details of this engine see POWER, April 1949, pp 117, 170. This mileage accumulation represented a total engine running time of 550 hr.

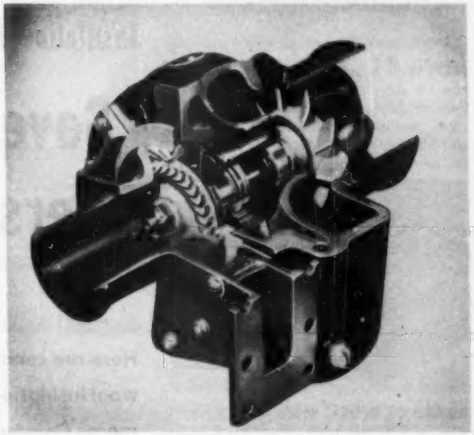
Test results are encouraging, though troubles were encountered. The road-endurance tests covering last 10,000 miles ran into the following troubles: occasional sticking of acceleration limiter, poor starting from low initial fuel pressure, burner blowout, turbine-blade damage from the passage of a piece of burner liner, turbine-blade rub, three blade-weld failures. All these troubles were subsequently corrected.

Fuel consumption runs around 1.0 to 1.2 miles per gal, and lube oil from 376 to 2380 miles per qt. Oil consumption is highly satisfactory, but the fuel needs are too high compared to present-day truck expérience, 3 to 5 miles per gal. The builders feel this can be corrected by: reducing drive line and transmission losses, reducing engine installation losses, redesigning truck chassis to take advantage of 2500 to 3000 lb deadweight saving because of lighter engine, raising engine thermal efficiency.

(*Continued on page* 212)

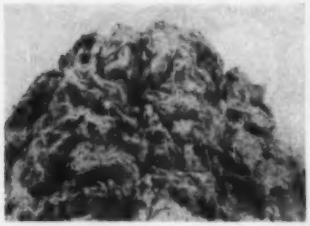


12 Radial-inflow turbines may use cantilever blade construction, *left*, or 90-deg inward flow rotors, *shown at right*



13 Miniature refrigeration turbine of the radial-flow type driving 1-stage axial-flow compressor as used in aircraft

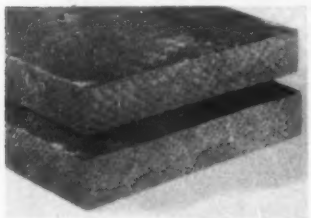
MINERAL-WOOL TYPES



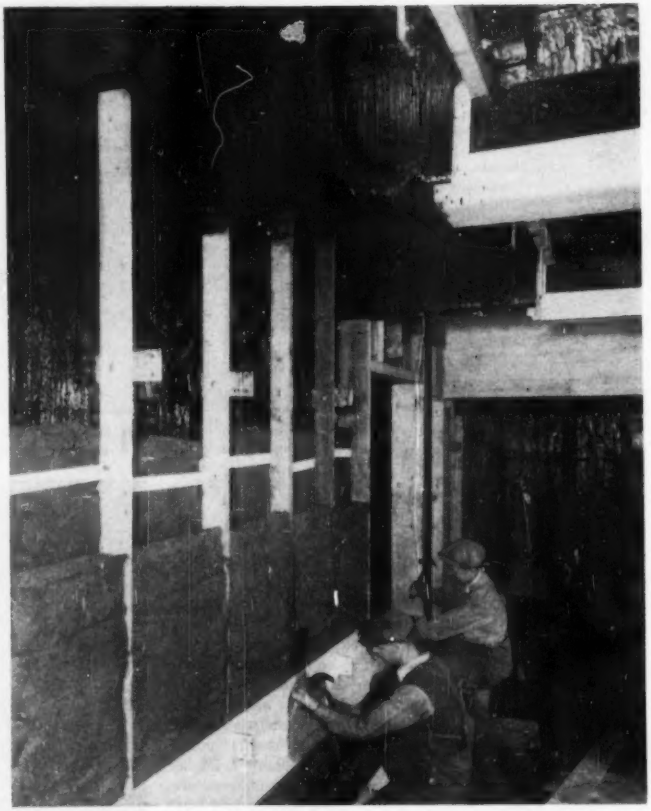
LOOSE WOOL is basic form. It is used as fill-type insulation for floors, walls and ceilings of refrigerated spaces, and many other jobs. Pliable, easily shaped

GRANULATED WOOL. Nodules are about ½-in. size. Used as fill-type insulation. Pours and divides more easily than loose wool. Good for hard-to-get-at spaces

FELT. With a binder added, mineral wool can be supplied as flexible or semi-rigid felt. Widely used on floors, walls, ceilings, compartmented panels, and pipes



BOARD OR BLOCK. Made with a binder it may or may not have a surface coating. Rigid, it is furnished in convenient standard widths, lengths and thicknesses



MINERAL WOOL FELTS being applied to the wall of a refrigerated space. Asphalt vapor barrier behind insulation and supporting strips between felts insure good job

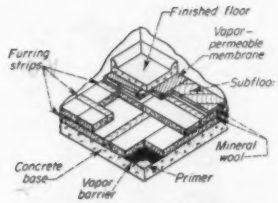
Insulation Handbook: Part 8

Save Cold-Job $$$ With Versatile Mineral Wool

By PHIL SWAIN, *Editor*

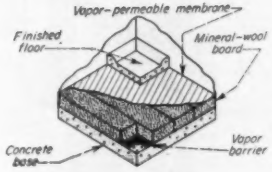
Here are condensed, easy-to-read instructions for using mineral-wool insulation on your cold jobs. Based on the U.S. Dept of Commerce *Commercial Standard CS105-48*, they summarize important points all power engineers having cold rooms should know

MINERAL WOOL IS USED WITH MANY TYPES OF FLOORS AND CEILINGS



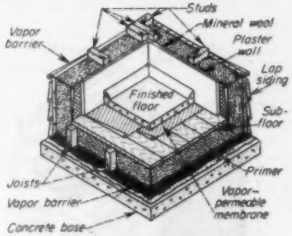
CROSS-FURRED

Use two or more layers of treated-wood strips for the cross-furring. Apply insulation in layers between the furring strips. Provide floor drains, if needed



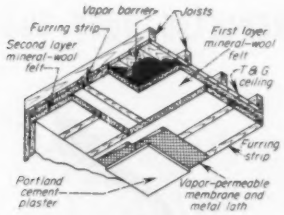
LOAD CARRYING

Use rigid mineral-wool board laid in hot asphalt. Build insulation up to desired thickness by using two or more layers. Apply finished floor over membrane



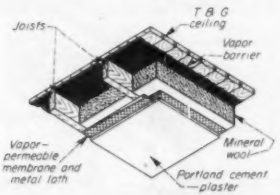
JOIST CONSTRUCTION

Treated-wood joists have a depth equal to the insulation thickness. Insulation should completely fill the space between the floor joists, as shown in the sketch



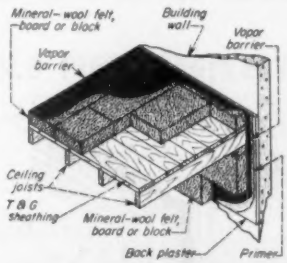
CROSS-FURRED

Two or more layers of treated-wood strips at right angles used for cross furring. Apply insulation in layers between furring strips. Vapor barrier on warm side



JOIST CONSTRUCTION

Treated-wood joists have a depth equal to insulation thickness. Insulation completely fills the space between the joists. Metal lath helps support wool



ABOVE-CEILING CONSTRUCTION

Apply insulation of right thickness to upper side of structural ceiling. Put vapor barrier on warm side of the mineral wool. Good for interior cold rooms

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► MINERAL-WOOL INSULATION is rock, slag or glass processed from a molten state into fibrous form. For low-temperature work it is available in loose, granulated, felt, batt, board and block form.

PROPERTIES

Thermal conductivity, K, at 50 F mean temperature will vary from 0.28 Btu per hr per sq ft per deg F per in. thickness for loose forms to 0.315 for block and board. Mineral wool is lightweight, its density varying somewhat with its form. It is moisture-repellent and won't corrode steel surfaces.

Inherently incombustible, mineral wool tends to smother fires and cushion explosions.

FLAT-SURFACE INSULATION

Table I, below, gives recommended thicknesses for average conditions, Table II, minimum recommended thicknesses. Greater thicknesses reduce refrigeration cost but choice may be modified by other factors like climatic conditions, exposure, building type, intended use, economics, etc.

I: Recommended Thicknesses Average Operation

Temp, F	*Thickness, in.*
To 35	3-4
35 to 20	6
20 to 5	8
5 to –10	10
–10 and below	12 or more, as specified

II: Minimum Recommended Thicknesses

Temp, F	*Thickness, in.*
To 45	2
45 to 35	3
35 to 25	4
25 to 15	5
15 to 5	6
5 to –10	8
–10 and below	10 or more, as specified

CONSTRUCTION MATERIALS

To get best results from your mineral wool the surface to which it is applied must be correctly prepared.

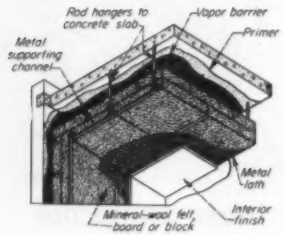
Monolithic Concrete. Be sure surface is smooth, free from paint, oil, soot, dust and loose particles before applying vapor barrier. Fill cracks and holes, and true up surface with portland cement mortar. Prime with asphalt primer before applying vapor barriers.

Unit Masonry. With brick, tile, cement and cinder block, stone, etc, make surface plane by applying one or more coats of portland cement plaster so all high points have a plaster cover at least ¼ in. thick. Plaster as given below.

Plastering. Roughen surface, if necessary. Be sure surface is clean before plastering. As soon as plaster is to be applied, wash surface with clean water and allow to dry until uniformly damp.

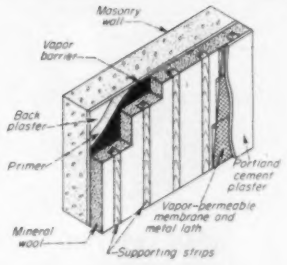
Mix plaster in proportion of one part

COLD WALL TO INSULATE? HERE'S THE RIGHT WAY TO DO THE JOB



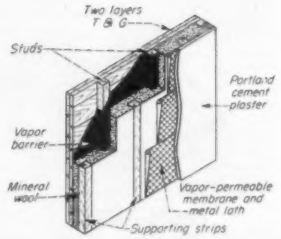
SUSPENDED CEILING

Suspend metal lath by hanger rods or by wires. Light metal channels support mineral wool. Apply metal lath and finish



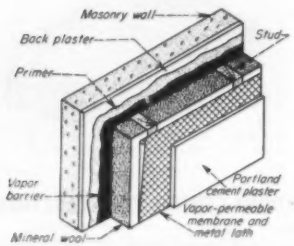
EXTERIOR MASONRY

Steel or treated-wood support strips have a depth less than insulation thickness. Finish with membrane, lath, plaster



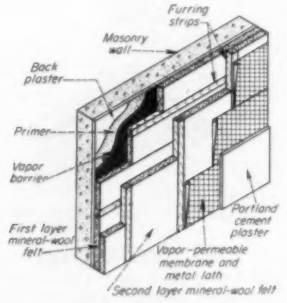
EXTERIOR OR INTERIOR WOOD

Use this method for exterior or interior wood walls with studs on warm (outer) side. Membrane, lath, cement finish



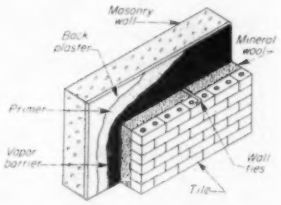
STUD CONSTRUCTION

Wood studs have depth equal to insulation thickness. Apply wool between studs. Finish with membrane, lath and plaster



CROSS-FURRED

Cross-fur two or more layers of treated-wood strips at right angles. Insulation goes between and over the furring strips



DOUBLE-MASONRY

Fill space between two self-supporting masonry walls with mineral wool. No finish is needed with this construction

portland cement to which has been added not more than 10% (dry weight) hydraulic hydrated lime, and three parts of clean sharp mason's sand. Add minimum amount of clean fresh water needed to give right workability. Apply plaster in one or more coats. Float to a smooth finish with a wooden straightedge.

Asphalt Primer. This is used on all masonry and plaster surfaces to which membrane-type vapor barrier is applied. Two coats of primer are brushed or sprayed on, the surface being dry before application.

Wooden Surfaces. These must be firm and smooth. Block off or cover all cracks, knotholes and other defects.

Vapor Barrier. To reduce air and water vapor infiltration into the refrigerated space, a continuous vapor-barrier membrane is installed on the surfaces of the warm side of the insulation. Membrane may be a manufactured product or built up on the job. Permeability shouldn't exceed 0.2 grain per hour per sq ft (ASTM Testing Method C214-47T, at 73F).

Built-up vapor barrier is made of not less than two layers of asphalt or other suitable vapor-resistant material. Apply a reinforcing membrane between layers. Asphalt primer may be hot molten liquid mopped on, asphalt mastic troweled on, or certain types of asphalt emulsions sprayed or troweled. Bond layers and reinforcing membrane tightly together to form a continuous sheet over surfaces covered. Be especially careful to insure continuity at corners and junctions of wall with floor and ceiling.

See that manufactured sheet materials used for vapor barriers meet the water-vapor permeability requirement. Use hot asphalt or cold asphalt mastic adhesive. Lap all joints at least 3 in., and cement with an asphaltic or other waterproof lap cement. Membrane may be applied with nails on wooden surfaces. Calk nailheads with mastic.

FOUNDATIONS

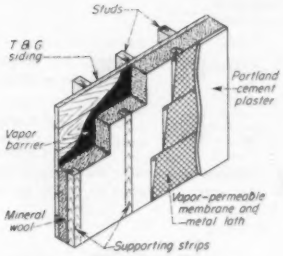
Be sure foundations and building structure are strong enough to carry expected floor loads in refrigerated space. Also, they should form a firm base for attaching vapor barriers and insulation supports.

When refrigerated space is supported directly on ground, and operating temperature is less than 32 F, special precautions are needed to prevent ground from freezing. Provide air ducts or other units to prevent freezing when water level in surrounding area prevents natural drainage away from foundation.

COLD PIPES

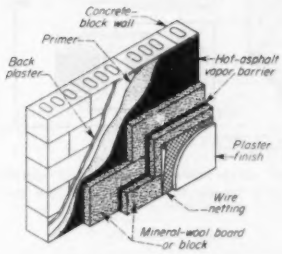
Build up mineral-wool insulation thickness on cold pipes, valves and fit-

INSULATE WOODEN, CEMENT BLOCK AND PLASTER WALLS LIKE THIS



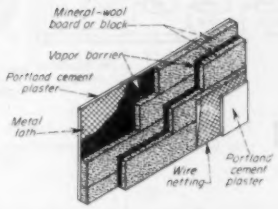
INTERIOR WOOD

Use this method for interior enclosing walls with exposed studs on warm (outer) side. Membrane, lath and cement finish



SOLID BOARD OR BLOCK

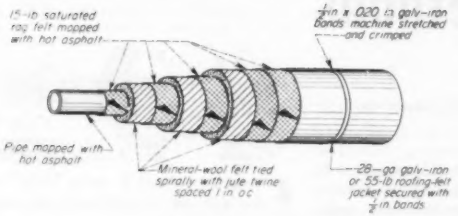
Exterior or enclosing walls use rigid board or block insulation. Apply in hot asphalt; one, more layers, joints broken



SELF-SUPPORTING PARTITION

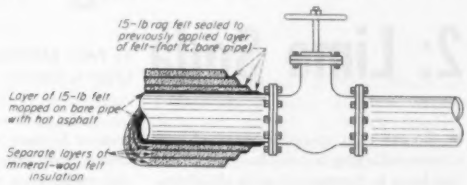
Erect by applying block or board insulation against temporary vertical wood partition. Remove wood after all wool is up

CUT YOUR REFRIGERATION COSTS. INSULATE COLD PIPES PROPERLY


15-lb saturated rag felt mopped with hot asphalt
½ in. x .020 in. galv-iron bands machine stretched and crimped
Pipe mopped with hot asphalt
Mineral-wool felt tied spirally with jute twine spaced 1 in. oc
28-ga. galv-iron or 55-lb roofing-felt jacket secured with ½ in. bands

INSULATED PIPES

Prime or mop with hot asphalt, or wrap with a layer of 15-lb saturated rag felt lapped 3 in. at all joints. Tie first layer wool over this with jute twine. Build up layers shown


15-lb rag felt sealed to previously applied layer of felt—(not to bare pipe)
Layer of 15-lb felt mopped on bare pipe with hot asphalt
Separate layers of mineral-wool felt insulation

PIPE SEAL

Seal off every 10-15 ft of straight pipe and all fittings, valves and flanges, as shown. Run each layer of rag felt down to one below, not to bare pipe. Insulate fittings same as pipe

tings to at least the values shown in table below for various operating temperatures in your plant.

III: Cold-Pipe Insulation

Temp. F	Pipe sizes, in.			
	¼–1¼	1½–3	3½–5	6 & over
	Insulation thickness, in.			
–15 to 5	3	3	3	3
–45 to –15	4	3	3	4
25 to 45	2	3	4	5
5 to 25	2	4	5	5

Prepare Surface. Thoroughly clean and dry pipe before applying insulation. Don't run system until after all insulation is on. Have at least 4-in. clearance in all directions around pipes and other equipment. Don't run low-temperature pipes close to heated surfaces. Protect covering that may be subject to abrasion.

Pipe Finish. Illustrations, above, show how to insulate pipes and fittings. Finish pipe by protecting insulation with a jacket of No. 28 gage galvanized sheet metal or with 55-lb roofing felt. Finish is applied after the second outer layer of 15-lb rag felt has been mopped with asphalt and put on pipe.

Lap each piece of sheet metal 3 in. against weather at all joints. Secure in place with ½-in. galvanized iron bands spaced on 8- to 12-in. centers, machine stretched and crimped. Lap roofing-felt joints in the same way. Use ½-in. galvanized bands, copper or soft galvanized wires spaced on 6- to 8-in. centers to hold insulation in place on the pipe. Be sure bands and wires are tight.

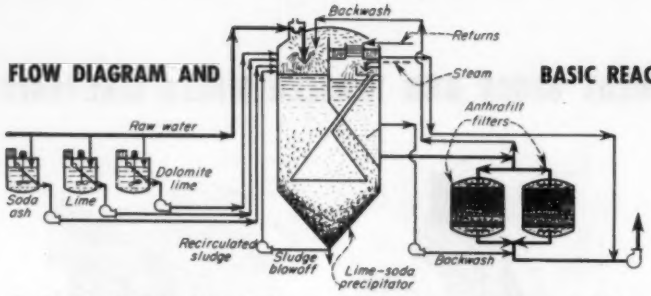
Fitting Finish. You can finish valves, flanges and other fittings in either of two ways.

1. Tightly stretch a layer of 1-in. galvanized wire mesh over the final layer of 15-lb rag felt. Secure in place with No. 18 gage wire. Then apply emulsified asphalt weatherproofing at the rate of 2 lb per sq ft of area. This is about ¼ in. thick, wet. Trowel it well into the wire-mesh netting.

2. Apply a layer of rosin-sized sheathing paper over the final layer of 15-lb rag felt. Lap it 3 in. at all joints. Seal laps with asphalt. Then sew or paste a jacket of 8-oz canvas over the rosin-sized paper. If sewed, space stitches not less than three per inch, located where visible.

Painting. When specified, insulation finished with weatherproofing is painted with aluminum or asphalt-base paint. Insulation finished with 8-oz canvas is given a coat of glue sizing, followed by two coats of white lead in oil, tinted to desired color.

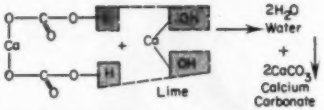
Lastly, remember that instructions given here have been condensed. To be safe use U S Dept of Commerce Commercial Standard CS105-48 for all cold jobs in your plant. Then you're sure to get good results.



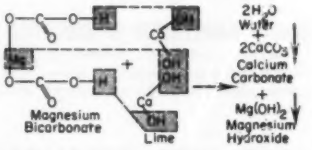
FLOW DIAGRAM AND

1 To get effective silica reduction, as well as primary softening and clarification with hot lime-soda treatment, raw water travels through a cycle like above

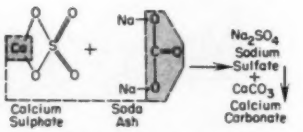
BASIC REACTIONS IN LIME-SODA SOFTENING



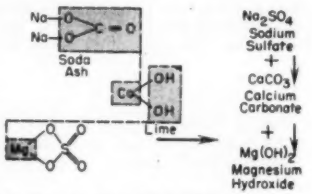
2 Calcium bicarbonate hardness in the raw water succumbs to lime's action



3 Lime also removes the hardness from any magnesium bicarbonates present



4 Soda ash added to water takes out the calcium noncarbonate hardness



5 Together with lime, soda ash acts on water's magnesium noncarbonate ions

External treatment of boiler waters gives good results. Just how good depends on picking the right system for your plant. Here's the latest practical know-how on . . .

Water-Softening Methods 2: Lime Soda

By **PAUL BRINDISI**
Chemical Engineer, Celco Laboratories

► TO GET FULL UNDERSTANDING of how a water-softening method fits your plant, you have to compare it with all others. We took the first step in making comparisons by studying the job zeolites do (POWER, Nov, p 84). Let's do the same now for lime-soda softening.

Softening by lime and soda ash ranks as one of the oldest of external water-conditioning methods. It still continues to be a most effective and popular procedure. Basically it converts the soluble salts of calcium and magnesium (together, they make up the total hardness of water) to near insoluble forms so you can remove them easily by settling and filtration.

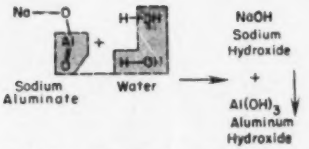
Here's briefly what the lime and soda ash do. Hydrated lime—slaked calcium oxide or calcium hydroxide—rids the water of most of its carbonate and bicarbonate hardness. This is the class of hardness that used to be called temporary because heat partially removes it. In raw waters this hardness exists entirely or chiefly in the bicarbonate state. Lime reacts with these soluble bicarbonates to precipitate calcium as carbonate, Fig. 1, and magnesium as hydroxide, Fig. 2.

Soda ash (sodium carbonate), on the other hand, eliminates most of the noncarbonate hardness from raw water. This type of hardness, once called permanent because heat did not affect it, comes from the compounds of calcium and magnesium other than the carbonates. In most waters the sulfates and chlorides predominate as these other compounds. Soda ash reacts with these soluble noncarbonates to (1) precipitate calcium as carbonate, Fig. 4, and (2) precipitate, with the aid of lime, magnesium as hydroxide, Fig. 5.

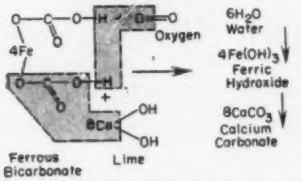
Softening Controls. Calcium carbonate, one of the principal agents in the lime reactions above, is not too insoluble. What's more, it becomes even less so. That is, more of it stays in solution, as the temperature goes up. Magnesium hydroxide, though, is quite insoluble and temperature increase has little effect. But because of it, residual hardness of a lime-soda softener runs mostly calcium carbonate. Just how much depends directly on operating temperature. With the cold process (50-70 F), raw water's total hardness can be pulled down to 40 ppm at best, and with the hot method (200 F +), down to 20 ppm. This method has little advantage for softening a moderately low-hardness water.

To keep control of the lime-soda processes, periodic tests have to be run on the effluent from each batch of an intermittent battery and during every work shift where a continuous system is installed. Back of these tests is the need to maintain a definite relationship between residual hardness and developed alkalinities as measured by phenolphthalein and methyl orange. Control is through regulation of lime and soda ash dosages. The exact control limits must be narrow, designed for maximum hardness removal under the specific operating conditions and with the type water under treatment.

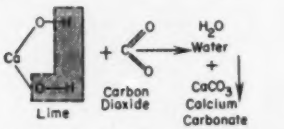
Further tests on clarity and silica reduction serve to govern density and height of the sludge bed, and also the



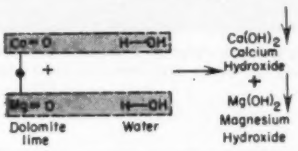
6 Sodium aluminate in water speeds up the settling-out rate by coagulation



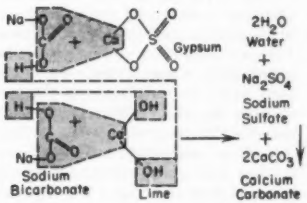
7 Any iron in solution drops out under action of lime and dissolved oxygen



8 Water's dissolved carbon-dioxide gas will be removed in presence of lime



9 Adding dolomite to the water introduces a lime and silica absorbent



10 Gypsum in the water will neutralize any existing bicarbonate alkalinity

degree of sludge recirculation where it is used.

An intermittent battery gives the best hardness removal because you can get a closer control over chemical feed. If you're using river waters where hardness varies quickly and all over the lot, the intermittent battery is the answer. The continuous system takes up a lot less space but it demands a persistent, more attentive regulation of chemical doses.

Cold vs Hot Process. In the cold process lime and soda ash have to be added in fairly large excess to suppress raw-water hardness to the lowest limit. In the hot process two things happen. First, hardness removal limit is lowered by about 50% more. In addition, softening action speeds up so only a small surplus of chemicals can force chemical reactions to near-completion. In addition, the higher the temperature, the lower the water's viscosity; precipitates settle out much faster.

With the cold process you may need four hours or more for the bulk of precipitates to deposit out in the reaction chamber against less than an hour for the hot continuous system. Temperature is the primary factor in rate of deposit but the extent of turbulence, baffling pattern, course of flow and design of softener can further speed the action.

How about chemical costs and behavior? Soda ash is more expensive than lime. Because of this a water having a greater noncarbonate than carbonate hardness costs more to soften because it needs more soda ash. Waters with larger magnesium than calcium content consume more chemicals to precipitate the magnesium out, and as a result charges mount higher.

Soda ash and lime produce different effects upon water. And these effects must enter into an appraisal of the job they do. For instance, lime by itself is practically insoluble and so are its products of reaction with the raw water's carbonate hardness. Result is a decrease in total dissolved solids. Soda ash, though, is highly soluble. When it enters into an exchange reaction with noncarbonate hardness compounds, it leaves in solution a weightier substitute salt as well as some of its own soluble self. So total dissolved solids increase under soda-ash treatment for noncarbonate hardness.

In general, softening a water higher in carbonate than noncarbonate hardness with the lime-and-soda process reduces total dissolved solids as well. If this hardness ratio is reversed, the process raises the total solids content.

There's still another problem that crops up in the use of soda ash. The more you have to use, the greater its tendency to combine with magnesium salts and form colloidal, complex basic carbonates that neither settle out nor are easily removed by filtration. When your softener effluent shows a persistently high alkalinity and hardness concentration, you can suspect these colloidal compounds are forming.

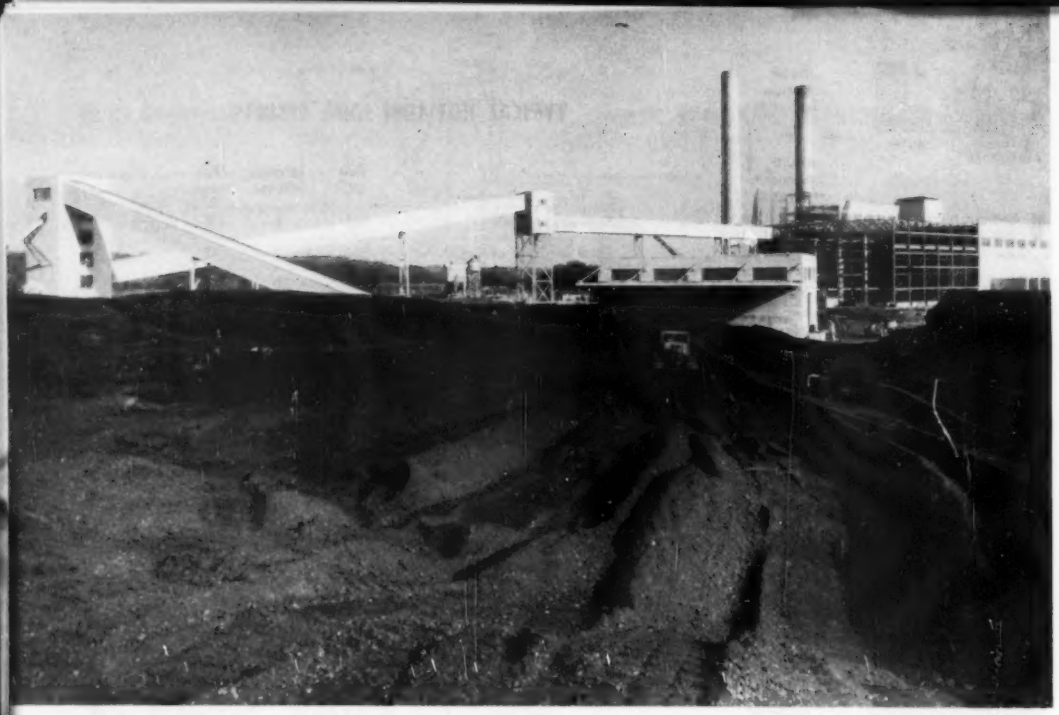
Because of this condition you can expect a high noncarbonate-hardness water with its need for heavy soda-ash treatment to produce a higher residual hardness than a water with lower noncarbonate but an equivalent total hardness.

How can you get around this difficulty? An aluminum coagulant will

(*Continued on page 216*)

TYPICAL HOT LIME-SODA RESULTS

	Raw water	*Softener effluent*	*Feed-water*
Turbidity as SiO_2	160	8	0
Total hardness as $CaCO_3$	360	24	12
Ca hardness as $CaCO_3$	246	20	10
Mg hardness as $CaCO_3$	114	4	2
Noncarbonate hardness	80	0	0
Carbonate hardness as $CaCo_3$	280	24	12
P alkalinity as $CaCO_3$	0	36	80
M alkalinity as $CaCO_3$	280	60	36
Sulfates as SO_4	274	274	137
Chlorides as Cl	56	56	28
Silica as SiO_2	22	0.6	0.3
CO_2 as CO_2	33	0	0
Total solids	1143	549	274
pH value	6.9	10.2	10.0



FIRES FROM coal-storage piles can be a thing of the past. Use of latest methods, particularly compacting, above, and coal-pile sealing, permits many large fuel users to lay up as much as 560,000 tons of coal in piles that are 100 ft high

How You Can Store Coal In Safety

• Select a dry, fairly solid, well-drained area

• Use a bulldozer to level it out, avoid major hollows

• Consider available coals. Some store better than others

• Pick the right storage method for your coal consist

► EVERY SO OFTEN the question of coal storage comes up. In localities like the Great Lakes area, large storage is an economic advantage. In others, it is an operating necessity. In any case every coal-burning plant employs coal storage and, like everything else, there is a right and a wrong way.

You can begin with the coal itself. All coals tend somewhat to take on oxygen in storage. Rate at which it is taken on determines the heat build-up in the storage pile. If the reaction is rapid, heat thrown off gets high. If it is high enough, the phenomenon of spontaneous combustion can start.

Coal Properties. There have been a number of attempts to classify coal according to whether it can or cannot be stored safely. Actually, there is enough know-how today to permit safe storage of practically all coals. It is true that those of lowest rank tend to heat up most rapidly. This tendency, however, decreases with time. But high surrounding temperatures can speed up the normal tendency, and once coal-pile temperature gets above 150 F, the danger of fire is great. Close temperature checks are in order.

Fundamentally, there are four known substances that contribute most to firing of coal in a storage pile. They are iron pyrites, water, oxygen and certain of the hydrocarbons.

The iron pyrites, water and oxygen combine to form iron sulfate and sulfuric acid in an exothermic reaction. This reaction serves as a pilot to trigger-off carbon and hydrocarbon reactions with oxygen already in the coal or from the air. Under normal conditions all that happens is a loss in heating value (somewhere under 1% for the first year, much less thereafter). If, however, there is enough air to feed this relatively slow action, the process speeds up and you have spontaneous combustion.

The obvious answer is to take steps that will prevent or slow down the oxidation of combustibles in storage. How about controlling the substances that can start fires—the pyrites, oxygen, water, hydrocarbons?

With today's cleaning and washing equipment at mines a portion of the iron pyrites (or what often constitutes the sulfur content) is removed from processed coal. Some seams run low in sulfur anyway and require little or no processing. From the storage-pile angle the logical move is to select a coal comparatively low in iron sulfides or iron pyrites.

Oxygen and water, of course, should

SEGREGATION can develop with bucket system of coal handling. So steps have to be taken to redistribute segregated coal and get needed 65-70 lb per cu ft densities

SEALING THE TOPS and slopes of coal piles pays off. Slopes are the weakest part. Here segregation is the most pronounced and air infiltration is the most likely

BULLDOZER gives flexible coal-handling from delivery point to the storage pile

be excluded as far as economically possible.

Hydrocarbons that figure in coal-storage fires can be measured by extraction with phenol. They oxidize easily and give coal its coking characteristics. It has long been a matter of record by both stoker-users and coke-oven operators that freshly mined coals have coking characteristics entirely different from coals from the same mine coming out of storage.

Even if a coal is low in sulfur content, has a low inherent moisture-absorption quality, still, possession of a high phenol-extraction index (that is, high in the objectionable hydrocarbons) or strong coking characteristic is enough to give it a poor storage rating.

Storage Methods. There are two basic storage methods. Both deal with control of air movement through the storage pile. In the one the idea is to insure a heavy flow of air through the pile. So much so that any heat generated in the pile is blown away before it can build up to any appreciable amount. The second is the exact opposite. It is designed to shut out all possible outside air.

The free air-flow method depends on ample air space throughout the entire coal pile. The fewer fines present, the better this method's chances for success. Because of this, sized coal—nut, stove, egg and lump—gives the best results. Take every precaution to see that the coal does not get broken up or compacted in the storage operation. Look out for things like dropping the coal from too great a height, tracking over the pile, or dragging the coal, especially if you're handling a friable coal.

With smaller plants, particularly hand-fired ones, this system of using a sized coal in storage is highly desirable, and so the method proves attractive. Great bulk of coal for steam-plant use, however, is not purchased already sized. In fact, much of it reaches the plant storage yard as run of mine, and must be stored in a different way.

The second method of storage, cutting off all possible air movement, is the most generally used, certainly on large storage piles. First step is to eliminate segregation, that is, the tendency of the larger coal particles and the fines to separate out, with particles of the same general size grouping together.

If you dump coal on a storage pile by bucket or belt, you'll find the coal always segregates. The fines stay in the center of the pile and the coarse lumps roll to the outside. This is a natural for spontaneous combustion.

To prevent it you have to rehandle this coal, spread it evenly and uniformly over the storage area and then compact it in layers. Compacting is most important. It performs several valuable operations.

Chief among these advantages is redistribution of the coal, eliminating segregation, and the packing action that effectively changes the density. Loose coal, for example, has a density of roughly 50 lb per cu ft. Under ordinary storage piling this density builds up after a number of years to a top of 58 lb per cu ft in the bottom layer of a 20-ft-high pile. Coal compacted by bulldozers weighs between 65 and 70 lb per cu ft.

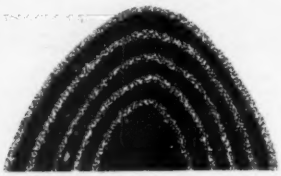
The Oswego Steam Station of the Buffalo Niagara Electric Corp[1] is an excellent example of the advantages of storage by compacting. They store as much as 560,000 tons in an area 1400 ft long by 400 wide. The pile towers as high as 100 ft in some places (general recommendation, about 20-40 ft). All the coal movement is carried out with bulldozer-carryall units.

These carryalls each pick up a 13-ton load, carry it an average of 700 ft

1 "Storing and Reclaiming Coal at the Oswego Steam Station," J Norton Ewart, ASME Paper No. 49-A-98.

COAL compacted and stored well stands with hard vertical walls after excavation

PILING COAL in horizontal leveled-off layers, squeezes out unwanted air space



LOOSE DUMPING of coal stratifies it and forms regular air flues between layers

to a spreading area. Here the unit lays down a ribbon about 13 ft wide, 40 ft long, 10 in. thick. Subsequent trips pack this ribbon down to the 70-lb-per-cu-ft densities mentioned above.

No effort is made at this plant to use separate piles although coal is purchased from 60 mines varying in volatile content from 17 to 30% and sized from slack to double screened and run of mine.

Rules for Compacting. In general, though, there are definite recommendations on size that have been advanced for good compacting. Sized coal or coal from which fines have been removed does not lend itself to successful compacting. Run-of-mine coals should first be crushed or screened and the sized coal put in a separate pile very definitely isolated by a passageway from the compacted pile.

A properly compacted pile goes together like drawing, top of page. A single layer of coal is spread out by drag or scraper with a bulldozer across the coal-storage area. Thickness of this layer varies from plant to plant (somewhere between 6 and 12 in.) Then additional layers, usually held to the same thickness, go on top of one another until the pile is completed.

Tamping with a heavy weight of comparatively large surface area is a second way of compacting a coal pile. One experimental pile reported[2] had Indiana 4th-vein 1½-in. screenings loosely stored in low piles. Fire kept breaking out. So a decision was made to try tamping as a means of compacting. Compacting, it was felt, would prevent fires.

Accordingly, a pile was built up of four 3 to 4 ft layers spread out by a locomotive crane over a storage area about 30x30 ft. A 3-ton tamper, made up of channel and angle iron with a flat reinforced concrete base of about 30 sq ft, was put to work on the pile. The locomotive crane lifted and dropped this weight on the pile compressing the layers. About 20% more coal could be stored in the same volume than with loose piling, and no fires developed.

Coal, properly compacted and stored, stands with hard, vertical walls when it is excavated. The pile itself is firm and very hard. It is so compact that water runs off readily even on very slight slopes.

The slopes are the weakest part of a compacted pile. It is here that segregation is most pronounced. What's more, the wind can force air into the pile at this vulnerable spot.

Several ideas have been developed to safeguard the slopes. Where a bulldozer is used it is frequently run up and down the slopes as the pile forms. The slopes are well compacted but at an incline that is much less than the normal 45-deg angle of repose. For a limited-storage area this reduced slope is a disadvantage.

You can, of course, use excavated basins with earth slopes or earth embankments with about a 2 to 1 slope. Both give fine protection but raise some problems on coal removal.

Sealing the Pile. Latest method is to seal the pile on top and bottom. Top sealing not only prevents air infiltration but reduces windage losses. You have several choices of sealing material—fines held in place by a thin covering of heavier coal, asphalt, oil or tar. All have been tried successfully.

The fine-coal sealing gives excellent results as long as it is packed down in a continuous, air-tight layer. Then a second, or outside covering, of larger pieces go down to prevent wind and rain erosion.

Back in the days when coal-pile fires were more of a problem than today, the Wisconsin Electric Power Co[2] ran several experiments on safe storage. They tried both asphalt and fine coal. The fines gave as good results as the asphalt and at a cost of only 2/3 of 1% of the coal cost (a 40,000-ton pile). The asphalt cost reached 1%. Heat loss ran less than Btu measurement accuracy. The fine-coal seal they used was a foot of minus 48 mesh followed up with a layer of coarse coal.

What's more, they found that any air leaks betrayed themselves with a characteristic telltale vapor discharge. Just by studying the pile during early morning, on a day of high humidity, or on a cold day, they found you can spot every air leak. A fine-coal patch in the leakage area seals off the danger spot.

The same vapor streamers coming off an unfireproofed pile means a fire eventually unless the coal is removed quickly.

The fine-coal method above supplanted asphalt sealing at the Wisconsin Electric Co. When using asphalt, they found the slopes were a constant source of trouble because the asphalt seemed to "bleed." They tried emulsified asphalt, then a mastic of asphalt and coal, and finally went to fine-coal sealing.

When storing small sizes some companies[3] have used an oil-treated coal to keep moisture absorption low and reduce windage loss. Then they cap this with a coal-gas tar.

They use special equipment consisting of a gasoline engine with a dc generator, a tar supply tank; electric heaters and a motor-driven pump apply about 200 gpm of tar at about 265 F and under 150-psi pressure. The tar goes on in four thin coats, about 5 gal per 100 sq ft of surface.

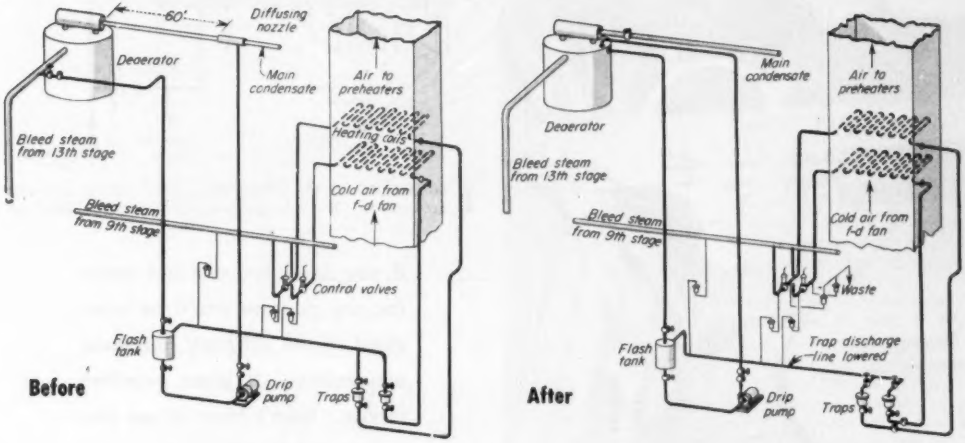
Putting Out Fires. What if overheating should develop? The best thing is to remove the affected coal. Water can stop heating but only if it reaches the danger spot. And unless you can get right to that spot, don't use water at all. Just spraying water on the pile does no good and can create problems of its own. But with proper compacting, storage fires are most unlikely and many companies store coal safely for years. Some use piles for emergency only.

These simple principles give good results: (1) select a good well-drained site for coal storage (2) carefully prepare the ground (3) pick coals less liable to fire (4) stock selected coal carefully, according to sizing.

2 "Storage of Coal," W L Lundy, Kimberly Clark Corp, ASME Paper No. 51-F-25.

3 "Storing Coal Safely," M K Drewry, *Power Plant Engineering*, August 1942.

Rx Could You Cure This Headache?



Case No. 7—

By D C SWIFT, *Ebasco Services Inc*

THE HAMMERING HEATING SYSTEM

► A NEW 650,000-lb-per-hr 1250-psig 950-F steam generator was fitted with steam-heating coils at the preheater inlet. These coils raise inflowing-air temperature so condensation of moisture in the flue gas at the cold end of the preheater is avoided. They take steam from the main turbine 9th-stage bleed point. This arrangement has many practical and economical advantages.

Layout. The left-hand dimetric sketch shows the original arrangement. Unit has two preheaters, forced-draft fans and heating coils. Only one set is shown in the sketch. Central control room regulates preheater inlet air temperature through the remotely operated control valves.

Heating-coil condensate traps out through a semi-common header to the vented flash tank. The low-head drip pump, controlled by high- and low-level switches discharges condensate to the deaerator through a horizontal run of condensate line about 60 ft long. The diffusing nozzle, a perforated pipe inside the condensate line, distributes the heating-coil drips into the condensate smoothly.

Deaerator pressure varies with turbine 13th-stage bleed pressure up to top of 60 psig. At low loads the 9th-stage bleed steam keeps deaerator pressure above the minimum 5 psig.

Live steam at 125 psig may be used instead of bleed steam in the preheater inlet heating coils. Part of the heating coil drip flashes into steam in the flash tank. The flash steam goes to the deaerator via the 13th-stage bleed line. The tank must be held at about deaerator pressure or the drip pump cannot force condensate into the main condensate line.

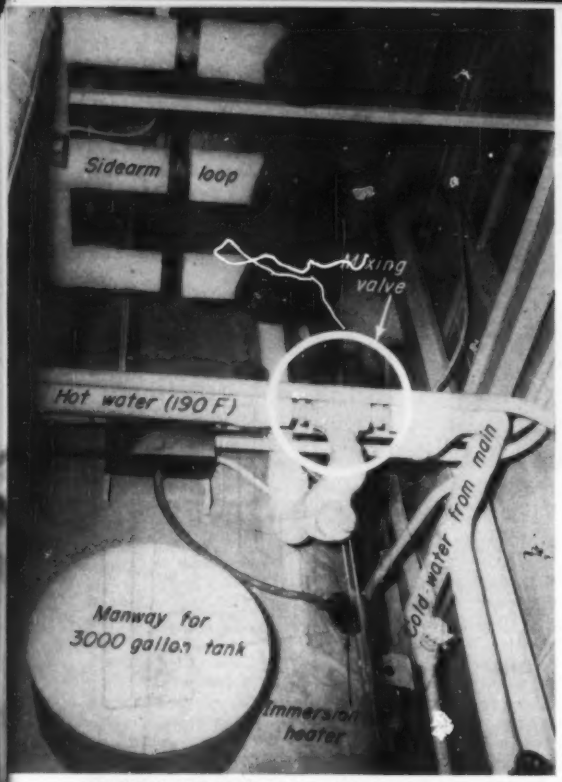
Trouble. This innocent-appearing auxiliary layout proved to be a wildcat when we first cut her in. Water hammer was so bad it threatened to tear apart pipes, valves, coils and deaerator vent condenser. The condensate line from diffusing nozzle to vent condenser, the heating-coil steam supply lines, drip lines from coils to trap, and discharge header from traps to flash tank all joined in a cacophony of sledge-hammer blows. Talk about the squeaking wheel getting the oil! This heating system wanted attention and was calling for it in no uncertain terms. We jumped to it.

Water hammer often occurs when steam enters a horizontal pipe partly filled with cold water or when steam enters below cold water and bubbles up through it. Rapid condensation of steam by the cold water causes heavy water surges resulting in hammering. If steam can be kept out of horizontal runs of water piping, or vice versa, water hammer is often eliminated.

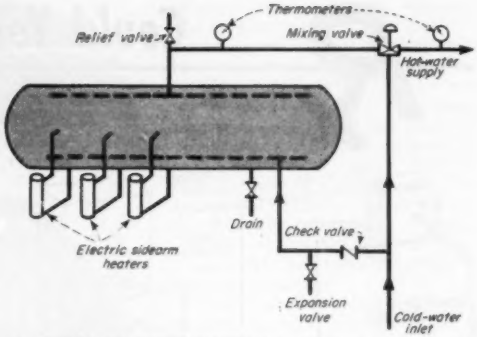
Water hammer took place in the main condensate line at times, despite the diffusing nozzle. Check valve in this line at the condensate-pump discharge seemed to let water and steam work back from the deaerator vent condenser (under 5-psig steam pressure) when the pumps were shut down. Cold water partly filling the line or entering from the flash tank caused heavy hammering as steam backflowed from the deaerator vent condenser.

Remedies. We installed a check valve in the condensate line at the vent condenser. We disconnected the flash-tank condensate line from the diffusing nozzle and reconnected it to enter the

(*Continued on page 214*)



2 **PIPING AND HEATERS** for a 3000-gal hot-water accumulator that heats water for a Nashville, Tenn., laundry plant



1 **SCHEMATIC PIPING DIAGRAM** for ideal electric hot-water accumulator. The individual sidearm heaters do a good job

If you need low-cost hot water for any purpose you'll be interested in the off-peak hot-water accumulator. It gives excellent service. Here's how to use one in your plant now

By **A C GIBSON**, *Manager*
Industrial Power Dept, Nashville Electric Service

Off-Peak Hot-Water Heating Saves Cash for Tennessee Industries

► OFF-PEAK WATER HEATING isn't new; utilities have published rates for this service for many years. Neither is the accumulator principle new. But combination of the two—an electrically heated accumulator—is new. Savings possible make it worth study by all power engineers who must heat water in areas served by public utilities.

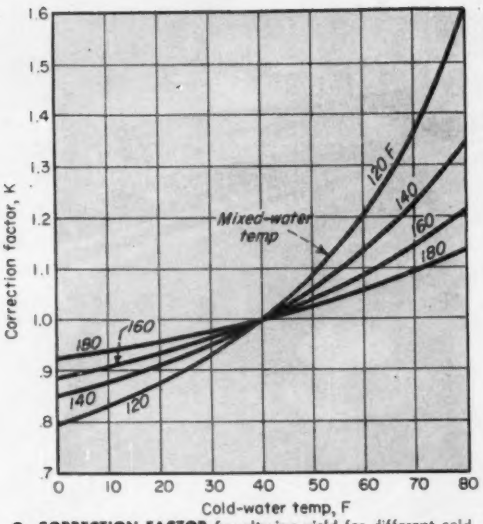
Accumulator Use. We've successfully applied the accumulator principle for water heating and storage in the Tennessee Valley area. Electricity heats water only at those times when plant electric demand is low. This may be during the day but usually only night-time heating need be considered. Control of heating load during day may be too difficult to keep plant electric demand below a predetermined peak. Though daytime control is possible, cost is high when normal plant demand fluctuates appreciably.

Typical arrangement, Fig. 1, has hot-water storage tank connected to city-water system so tank is always under pressure. Water in tank is heated to about 250 F and piped to an automatic 3-way mixing valve. In valve, hot water is mixed with cold water from city main to obtain desired outlet temperature. All heat stored in water is utilized, needed storage volume reduced and better use of space and equipment obtained.

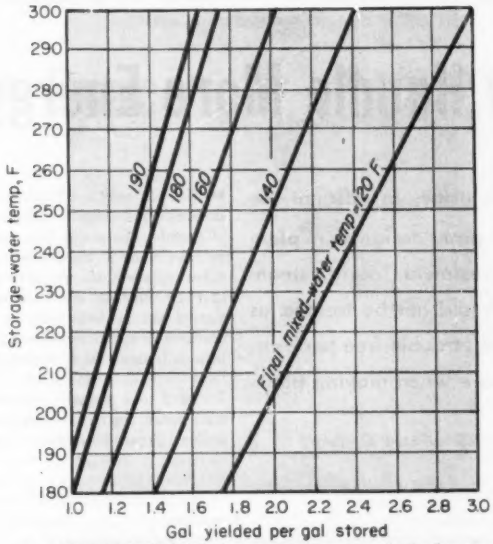
In most installations hot water is used for sanitary purposes in rest rooms, showers, restaurants, etc, but no changes are needed when water is piped to production. Also, water may be delivered at more than one temperature by simply installing additional mixing valves. For example, dual water services are required in plant cafeterias where 140-F water is used in pot sinks, 180-F in automatic dishwashers.

Limitations. One kwhr heats 3.5 gal of water 100 F. This is an approximate relation that takes heat losses into account. Temperature rise of heated water must not be great enough to cause tank pressure to rise above water-supply pressure. Tank pressure greater than supply pressure can cause poor mixing and cavitation effects in the system.

Where space is restricted, installation of storage tank and heaters, Fig. 2, may be a problem. When total water consumption is known or can be estimated, find storage volume needed by factors from Fig. 4. It shows quantity of hot



3 CORRECTION FACTOR for altering yield for different cold-water temperatures. Use is explained in text of article



4 ACCUMULATOR YIELD for various storage and mixed-water temperatures. Use this handy chart in the designing system

water obtained from each gallon stored at elevated temperature when mixed with 40-F cold water. Correct yield value for actual cold-water temperature by applying correction factor from Fig. 3. In most plants it is desirable to design for the minimum water temperature expected. Also, maximum yield under best operating conditions is figured.

Usual practice assumes only 75% of water stored can be drawn from tank without appreciable drop in water temperature. But we've found that 90% of water stored can be used if perforated feed pipes are employed for injection and withdrawal. Typical calculation for yield is then made like this:

Example: Hot water at 250 F is stored in a 1000-gal tank. What is maximum yield if mixed-water temperature to plant is 140 F, 90% of stored water can be used and cold-water inlet temperature is 50 F?

Solution: From Fig. 4, 2.0 gal of water per gal stored is obtained when mixed-water temperature is 140 F. Correction factor for 50-F inlet temperature, Fig. 3, is 1.06. So actual yield per gal stored is (1.06) (2.0) = 2.12 gal. With 90% of water usable, 0.90(1000) = 900 gal can be drawn from tank. Maximum yield of 140-F water is 900(2.12) = 1908 gal.

Feed Pipes. Drill enough ¼-in. holes in feed and withdrawal pipes to give a total discharge or inlet area at least twice that of feed or withdrawal pipe. Space holes uniformly in a straight line along entire length of pipe. This gives even injection and withdrawal throughout tank length. Temperature stratification is better, assuring greater heat use.

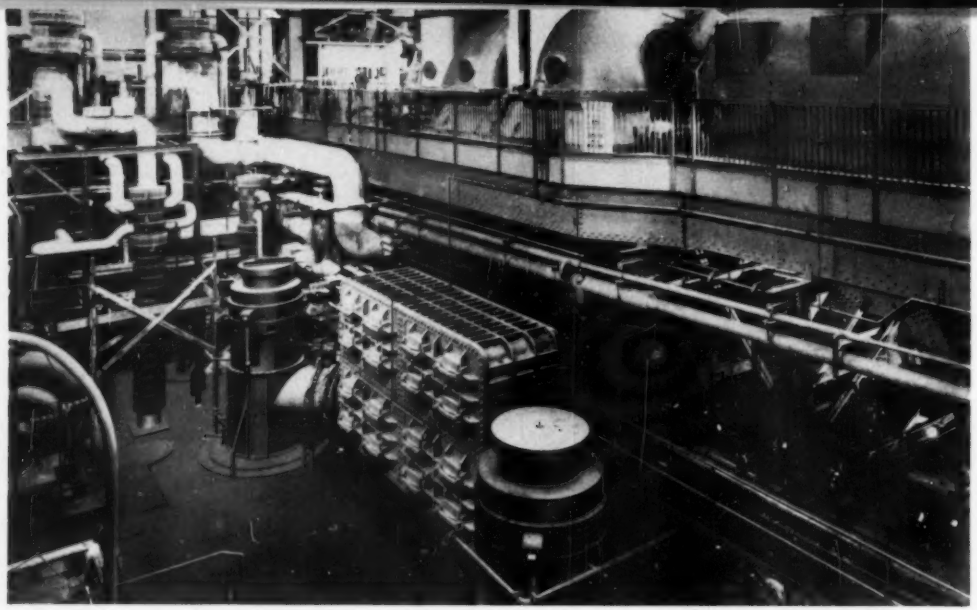
Our installations show no great difference between storage efficiency of vertical and horizontal tanks when perforated feed pipes are used. Temperature stratification in vertical tanks is more pronounced. As a result location of control thermostat can be critical if it turns on heating elements to give more heat during water withdrawal. Ordinarily the thermostat is placed 1/3 up from bottom of tank but with a pump for forced circulation during off-peak heating, thermostat may be anywhere except at top of tank.

Heater Type. Sidearm heaters, Fig. 1 and 2, do best job. They're made by placing an ordinary immersion heater in a pipe jacket and connecting it to tank with a pipe loop. By valving loop it's easy to maintain heater without draining tank. Fit thermal cutout in heater circuit to prevent burning out. Use of individual sidearms, Fig. 1, is preferable to groups in parallel.

Circulation. Use a circulating pump when sidearm heaters are fed from a single loop instead of being individually piped to tank. Pump is also useful when water is heated in an exchanger. Run pump while water is being heated, shutting it down when water is withdrawn from tank. Circulation of water during withdrawal destroys stratification, reducing storage efficiency.

Expansion of water during heating requires use of a relief valve. Install this valve on cold-water line close to tank, Fig. 1. This prevents waste of hot water. Spring-loaded ball-bearing-type relief valve has given us best service without noise or leakage.

Besides this valve, state codes usually call for a hot-water relief valve. Tennessee State Boiler Law requires one rated in Btu per hr, set to open at a higher pressure than the cold-water valve to save hot water.



1 To realize large unit capacities, main condenser layout must be as closely engineered as turbine and boiler. Here's 75,000-sq-ft single-pass condenser serving 165,000-kw turbine-generator. The condenser uses vertical circulating pumps

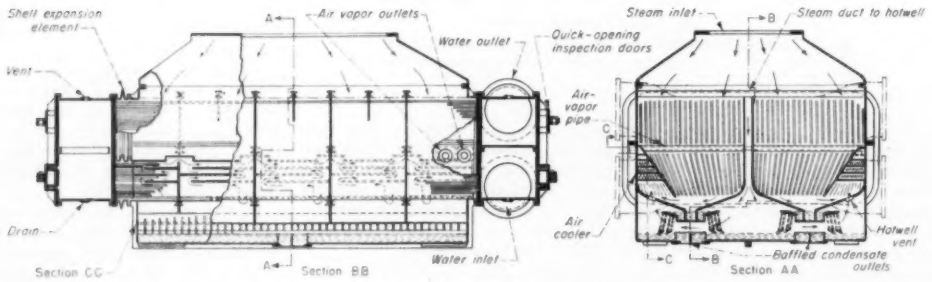
Condensers Now Handle More Energy in

Condenser designers have made great strides in efficient use of space. This has helped steam-electric plant designers in planning more kw per cu ft to keep down investment. Today's steam condensers being highly engineered should not be treated as the plant "catch-all" if you want efficient, trouble-free performance. Treat condenser flexibility with care when making plans

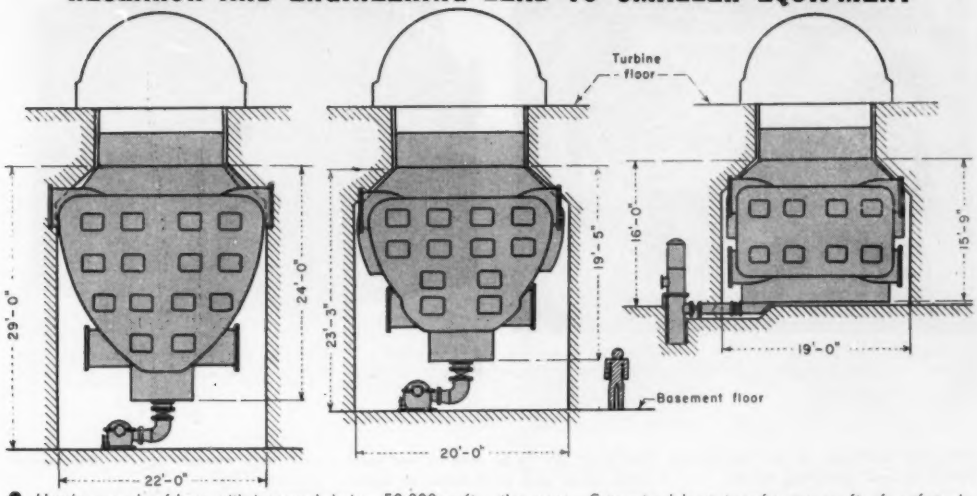
By G H PUTNAM, *Manager, Condenser Dept, Ingersoll-Rand Company*

► Up to about 30 years ago, condensers were largely designed by rule of thumb. The major idea seemed to be to crowd in a maximum number of tubes. Since then we have recognized that an efficient and economical condenser can be built only by strict adherence to sound fundamentals and by lessons learned from experience in the laboratory, shop and field.

Fig. 3 and 4 show a typical design for a large, modern, steam surface condenser. Steam flows down from the top



4 Side and end elevation sections through modern condenser with two passes shows water path and tube layout. Condensate enters deaerating hotwell by overflowing through sealed trays. Noncondensable gas leaves through aircooled sections



2 Here's example of how, with improved design, 50,000-sq-ft surface condenser with 24-ft-long tubes has shrunk over the years. Guaranteed heat transfer per sq ft of surface is about same for all three. Better efficiency means less metal

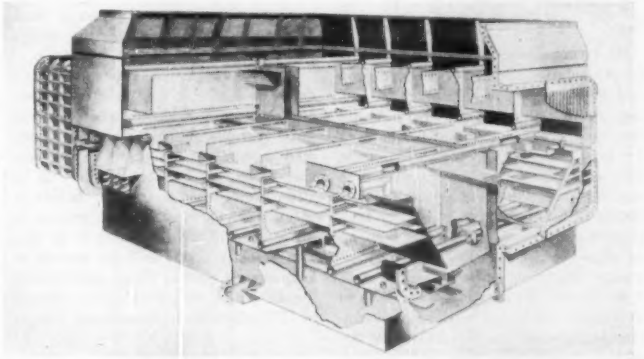
Less Space

over the tube bundles. Most of it condenses on the surface of the tubes. Entrained air and gas with some residual steam turns at the bottom of the bundle to enter the air-cooler sections on each side of the shell. After passing through these multipass sections the noncondensables, entraining a very small amount of steam, flow on to the air-removal equipment.

The condensate falling as a rain off the tubes collects in trays below the tube bundles. After passing through a U-trap seal around the baffle, separating the hotwell from tube-bundle space, the condensate falls into the hotwell through many small-diameter holes. Steam from turbine exhaust flows downward through the central shrouded duct into the hotwell at full exhaust pressure and temperature. This steam reheats the condensate and effects its deaeration. Excess steam and noncondensable gases vent from the pressurized hotwell into the air-cooler sections.

In the longitudinal section, Fig. 4, the tube-support plates divide the tube-bundle exterior space into short compartments. The steam dome distributes steam to the compartments in proportion to their condensing capacities.

The air and residual vapor cascades through the air-cooler sections back to the cooling-water cold-inlet end.

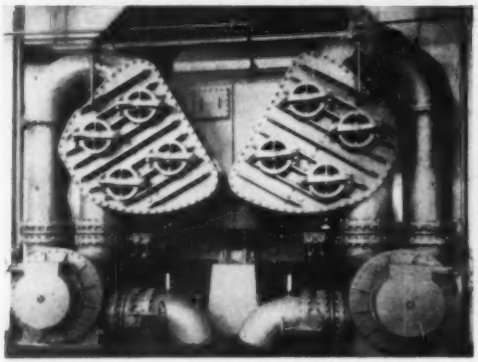


3 Section through a modern steam condenser emphasizes intricate steam baffling needed to make efficient use of all heat-transfer surface, prevent subcooling

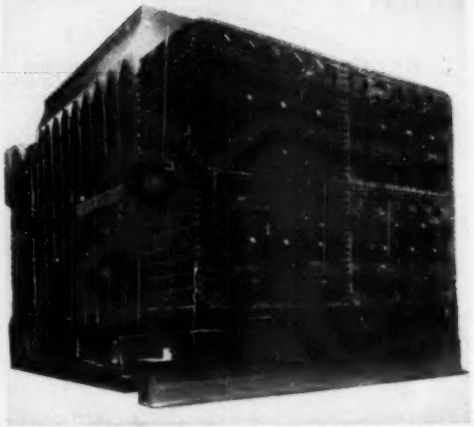
Design Problem. To use all heat-transfer surface with maximum effectiveness, steam must reach it with the highest temperature possible. In addition, all insulating air must be kept away from tube surfaces as much as possible. A clean single tube surrounded by air-free steam, with cold water flowing through it, condenses steam at a high rate of heat transfer. But with a large tube bundle a pressure drop must be used to drive the steam down to all the tubes. Drop in steam pressure causes a corresponding drop in temperature.

This reduces the temperature head between steam and circulating water, and the heat transfer as well. Optimum design is a compromise between minimum pressure drop and adequate steam distribution. To arrive at a compromise, other factors must be considered.

Pressure drop in a condenser depends on steam flow and absolute pressure. Taking 100 as value of pressure drop at full-load design point and 1.5 in. Hg abs as the pressure at condenser inlet, the following table shows pres-



5 Condenser for limited headroom with 27,500 sq ft surface has two tube bundles, reversing valves in the water lines



6 Condenser's 16,370 tubes make it one of the largest ever built, although some units exceed it in terms of surface

sure-drop variation in any condenser over a typical operating range:

	Abs press. in. Hg					
	0.5	1.0	1.5	2.0	2.5	3.0
Load, %	*Relative pressure drop*					
100	282	147	*100*	76	62	52
50	141	74	50	38	31	26
25	71	27	25	19	15	13

This shows that a condenser, having proper relations between pressure drop and steam distribution at nominal design point, may have excessive pressure drop at the same load and 0.5 or even 1.0 in. Hg abs. These conditions exist with cold circulating water. This may not be serious when the turbine does not operate under these conditions for long periods or if the turbine cannot respond to these low pressures with proportionate reduction in steam rate. But at 3 in. Hg abs the pressure drop falls to a relative 52. This represents warm-circulating-water conditions where the turbine responds to improved vacuum.

When the pressure drop is made just enough to give proper steam distribution at 1.5 in. Hg abs, the drop at higher pressures will not be adequate to give proper distribution. Then the condenser cannot be as effective as might be desired.

Load variations cause similar results. It becomes impractical to design for optimum performance under all operating conditions. This leads to need for another compromise in determining steam distribution and pressure drop.

Purchasers often specify one condition as the design point. We have known many that were far from the average annual operating condition. For example, an operator may know that he will have relatively cold circulating water, about 60 F average, for most of the year. But to be sure he can carry peak loads with 85-F water at 2.5-in. Hg abs exhaust, he will specify that as the design point. It would be much better to select a condenser capable of meeting the peak condition but designed for optimum performance at the average water temperature and average load. These averages should be the design point.

Air Leakage. Air leakage can be held down to 1 cfm or less in a condenser, and removed at that rate, and still leave large sections of the surface air blanketed in improper designs. The only way that tubes can be kept air free is by steam flow driving air away before it. Steam velocity must be high enough in all sections of the condenser to do this. The velocity must be high enough to keep the air moving ahead and through the air outlet. Air must not be allowed to (1) recirculate because steam velocity isn't high enough or (2) seek some stagnant corner.

One cu ft of free air occupies about 30 cu ft inside a condenser at 1 in. Hg abs. So keep air leakage down, but make sure you have enough steam velocity to drive air out. A slight compromise might be needed to get good balance between steam velocity in all sections and what might otherwise seem to be excessive pressure drop. Air blanketing affects condenser performance more adversely than excessive pressure drop.

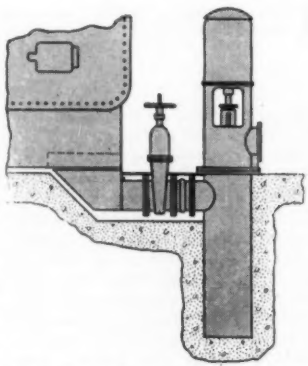
In passing through a condenser, steam contracts in volume by a ratio of about 40,000:1. For a 75,000-kw turbine running at full load this contraction takes place in about a half second. This fact plus the danger of air blanketing is why condenser salesmen talk about converging steam-flow paths from inlet to air outlet.

Choosing a Condenser. Many factors must be carefully weighed in choosing a unit for a given installation:

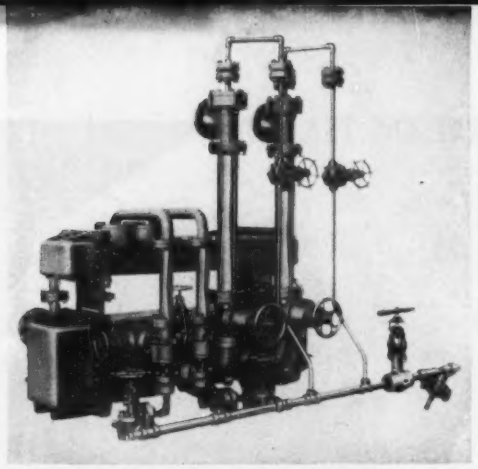
Water: (1) Quantity available, source, such as lake, small stream, ocean, cooling tower, etc; (2) quality, fresh, brackish, salt, clean or contaminated with slime, sewage, industrial waste; (3) temperature variation. These three factors influence tube size, length, gage, material, design absolute pressure and cleanliness, water velocity, number of passes, physical construction.

Physical size: Influences tube length, possibly tube size, arrangement for shipment and erection.

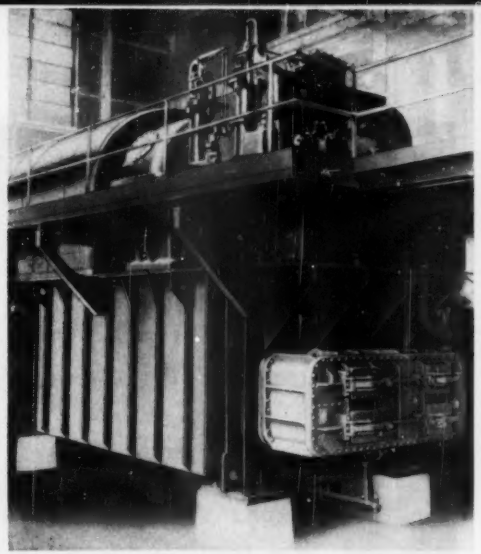
Economics: Load factor of unit, auxiliary power cost, circulating pump head, turbine response to improved vacuum, cost of steam, condenser installed cost, amortization rate, influences design ab-



9 Vertical condensate pumps contribute to reducing headroom needed by unit



7 Typical 2-stage twin-element air ejector for large-surface condenser can make or break the condenser performance



8 This 7150-sq-ft condenser acts as the foundation for its 10,000-kw turbine generator. Makes compact power unit

solute pressure, water temperature, tube length and size, number of passes, water velocity, erection arrangement.

Available space: Type of turbine foundation, width, height, length, siphon limitations, water tunnel arrangements, right angles or parallel to turbine shaft, influences tube size and length, shape and proportion of shell, arrangement of water connections and piping.

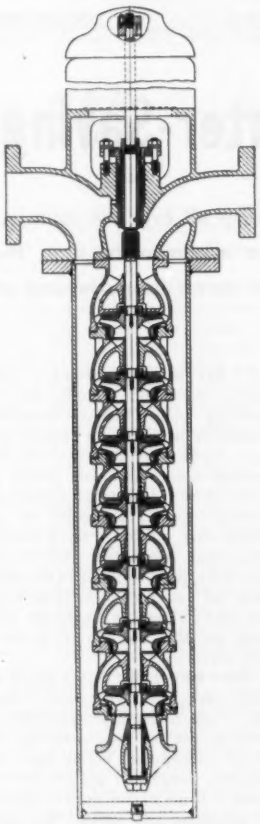
Operation and maintenance: These procedures affect various physical features of construction.

Trends. Development of high-temperature high-pressure units and the resuperheating cycle as well as large capacities of turbines have reduced the exhaust flow per kw. But the former items have resulted in much more compact turbine designs and foundations. In addition, headroom is reduced because of high building costs or fitting a unit into an existing small space. These factors have forced the condenser designer to fit his shell into smaller spaces, Fig. 2, without sacrificing heat-transfer performance. In fact, equivalent efficiencies in terms of materials and space needed to perform a given energy transfer have steadily improved with the years.

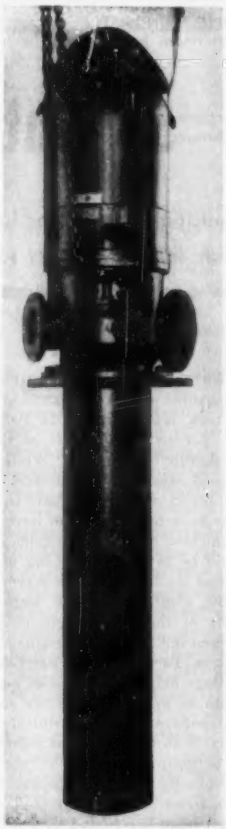
Fig. 8 shows an example of a trend to have condensers also serve as a foundation for their turbine-generators. We advise investigating relative costs between this type installation and the conventional before making a decision. We feel this arrangement is limited to small units. Costs for large capacities are generally prohibitive.

Auxiliary development has kept in step with advance in condenser design as shown by Fig. 7, 9, 10 and 11. The

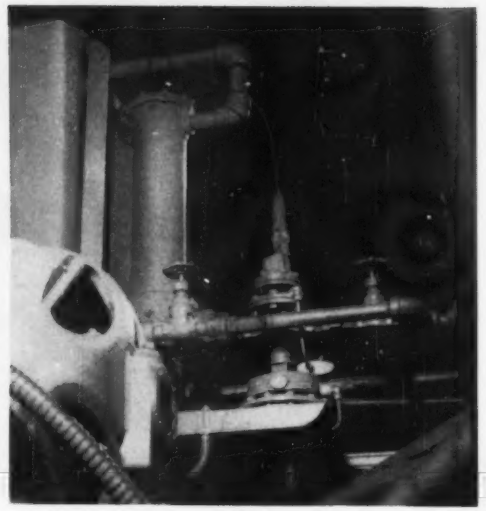
(*Continued on page* 220)



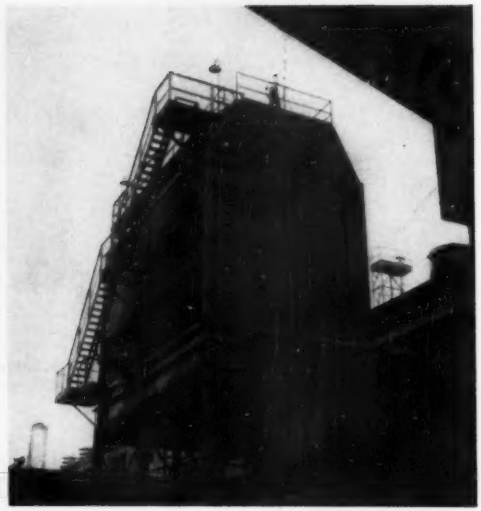
10 Vertical condensate pump has its stuffing box always under pressure



11 Complete vertical condensate pump has motor drive mounted on its top



SIMPLE THINGS, like self-contained regulating valves, can often return heavy savings in normally wasted water dollars



COOLING TOWERS, made a part of closed cooling-water cycle, permit you to salvage water for use over and over again

5-Point Water-Saving Program Cuts

Municipal water rates have gone up all over the country. So much so that it pays to conserve all down the line. Here's how one leading industrial cut its water usage in easy steps

► WATER IS NO LONGER considered inexhaustible and, in the quantities industry uses, it's not cheap. In 1948, when cost per thousand cu ft at the East Pittsburgh Works of Westinghouse jumped 36%, a water-conservation drive was set in motion. Its goal: Get water costs back to pre-increase levels.

Quickest way to get results, we felt, would be to identify the big users. To do that we had to run a survey of the entire plant. There, we were lucky. Many of the plant's departments are metered individually. So we had records to go on. These data plus water-company readings helped us establish month-by-month as well as total water consumption patterns for departments under study. With these patterns we could figure out a proper approach.

Generally there are five ways to conserve water in an industrial plant: (1) Run a plant survey and then (2) establish a program that makes everybody water-conscious—practically no expense. (3) Put in self-contained regulating valves, automatic shutoffs, and recirculating pumps wherever possible — especially adaptable to smaller plants, and relatively inexpensive. (4) Install cooling towers that will permit large scale re-use of water in various plant services—usually applicable to larger plants only, involves a fairly expensive, long-range investment. (5) Set up a follow-up, policing check to see that you hold all your gains. At Westinghouse we used all methods eventually, but the program itself was run off in the one, two, three order.

Plant Survey. We visited all the large water-users first. What we did was to contact the department supervisors, talk over our aim and more or less get everybody's cooperation. We hit hard on the obvious, things like shutting off water when it is not in use, good maintenance of pipelines and valves. We stressed their importance to the supervisors and the fact that they offered the least expensive means of saving useable water.

Once this phase of the program was rolling, we located the spots where ordinary hand control and conservation measures fell short. Many of them needed step 3 of the general industrial water-saving program—automatic shutoff, and recirculating and temperature controls. But for each such need specific recommendations, plus estimated installation costs and resulting savings in dollars, had to be worked up and pass the test. That test was a simple one. Every installation had to offer definite savings per dollar spent and that had to include costs of maintaining the equipment.

Spot Savings. Some departments rearranged piping layouts and water use to effect remarkable savings. For instance, one section employed cooling water for several brazers and degreasers. Formerly this water, still clear, went to waste after it had passed through the equipment. Today they collect it into a single discharge line. Then they use this line to supply clean water to glands on an annealing furnace and several rinse tanks in the same area.

Further, an oil hydraulic press in the same department had a heat exchanger to cool its oil. A one-inch water line fed this heat exchanger and apparently the line ran wide open all day. In fact, we

5 BASIC STEPS ANY PLANT CAN TAKE FOR CERTAIN WATER SAVINGS

I Plant Survey

Get together all recorded data on plant water use, department by department if possible. Install meters for big users, and then study their water needs.

II A Going Program

Make everybody water-conscious. Post signs warning of waste. Check on all obvious leaks, wide open valves, needless contamination.

III Low-Cost Mechanical Aids

Put in self-contained regulating valves, automatic shutoffs, recirculating pumps so water is used only as it is needed, and is always under control. This eliminates overuse.

IV Major-Use Changes

Heavy water-users need close study. See if there are ways of closing cooling-water cycle. Adding cooling towers so water can be reused may be in order.

V Constant Policing

No program is self-perpetuating. You've got to keep on top of all uses of water. Check up regularly and thoroughly to establish good water habits.

Operating Costs 36%

By J H IRVING, *Works Engineering Department*
Westinghouse Electric Corporation

doubt if it was ever shut off even for the weekend. A self-contained temperature-regulating valve, set to maintain oil at a safe operating temperature, went in the line. Water consumption at this one press dropped 75%.

In still another department a furnace cooling system ate up water at a 100-gpm rate. We put in a circulating pump in this system with a temperature-regulating valve to control makeup. The valve setting maintains water temperature at the furnace outlet high enough to save water and yet low enough so the water won't deposit out any solids in the pipe. Water consumption was cut 50%.

The heat-treating department solved one heavy water-user problem that could happen to anybody. There a standby gas compressor operates only when gas pressure drops below a set point. The compressor starts and stops by a pressure-control switch. Sometimes this compressor sits for a month without running, but it always has to be ready and so the cooling water flowed on. Then we put in a solenoid-operated valve in the cooling-water line. The solenoid works through the motor-control circuit. When the compressor-motor starts up, the valve is energized and the cooling water flows. When the compressor shuts down, the valve closes off and water stops. This system of automatic on-off has been fitted into many similar spots around the plant.

Heavy Investment. The larger water users needed more drastic methods involving cooling towers. This means a larger and a longer-range investment, not always economically sound. In a few cases at our East Pittsburgh plant cooling towers proved the only practical way to conserve water. And when they did go in, very good savings resulted.

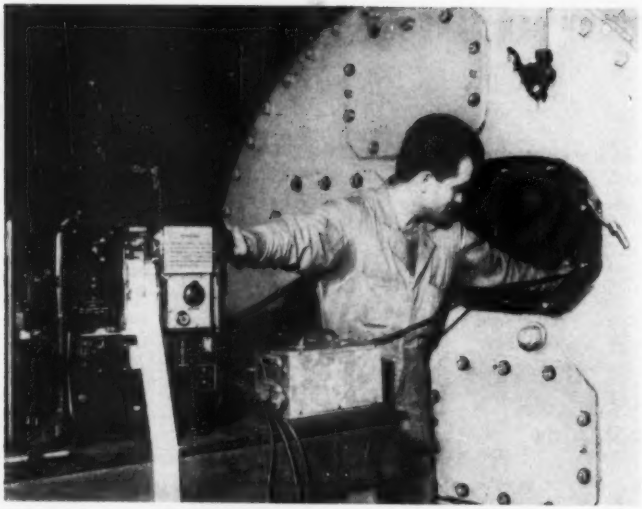
One such case was a 200-gpm cooling tower. It was put in to serve the cooling-water system of a large number of brazing machines and welders. The tower design permits up to a 50% load increase in equipment it serves. But at the existing load, savings on the water bill will pay for the tower in 3½ years.

In the powerhouse a cooling tower was built in the cooling-water cycle for air compressors, heat exchangers and other equipment. City water was used before the installation and the return water re-used for various other purposes. After the tower went into service much of the equipment was made part of a closed cycle and the quantity of return water cut down. More water was then needed to substitute for this lost supply. Clean water from all over the shop was routed to the powerhouse for this service. When all the rearrangements were completed, the total water bill in the powerhouse was reduced about 60%.

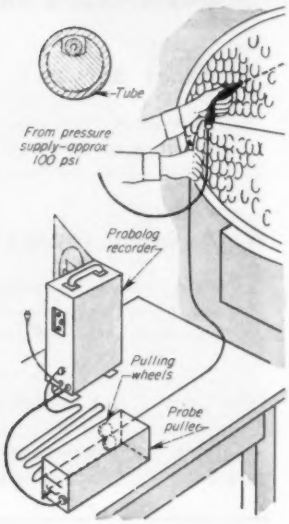
But remember this. No water-conservation method is self-perpetuating. It needs periodic checking. At Westinghouse we use a monthly check-up system. Any increase in water use calls for close investigation to see if (1) available water-conserving equipment is being used (2) it is operating properly. When a new water-using machine goes in, every possible means of conserving water is made a part of the initial installation.

Results make or break a program. At the East Pittsburgh Works those results have been excellent. The year 1949 saw a big drop from the 1948 consumption. But in 1950 we hung up a record that was lower than it had been in ten years. In spite of a 36% jump in rates, the 1950 bill was 5% under the 1947 one, our last full year at the previous unit cost.

On the basis of our step-by-step experience almost every plant can pick up parts of our program and expect some savings. The beauty of it is that you need go only as far as you like; build up enough facts to indicate whether heavy investments are in order.



SENSITIVE PROBE UNIT



1 Sensing probe element is shot the length of condenser tube and reeled back by puller element, *right*. Carries information for permanent charting on recorder

Catching Leaks Before They Happen

Here's a testing tool that gives you X-ray vision, permits you to put your finger quickly on just which condenser tube is about to fail

► RETUBING A CONDENSER, a heat exchanger or an ejector has always been a tedious job. If you've ever had to check the tubes going in for soundness or to identify which tubes, already in, need replacing, you know that job's an even worse one. Yet today there's a practical, quick way of doing the work.

Out at Detroit Edison Co the mechanical division of the research dept has the job of inspecting nonferrous tubes in power-plant heat-exchanger equipment. Visual inspection is out of the question. The usual tube is too long and, for that matter, not accessible when in working position.

The hydrostatic test (forcing water under high pressure into the shell around the tubes) uncovers only tubes that have already failed. Of equal importance is some way of identifying the tubes that are in danger of failing or that have just about lived out their usefulness. This you can get with a special device called the Probolog, above. It is put out by the Shell Development Co, Inc. There is no comparison between the answers it gives and the ones revealed by, for instance, the wasteful practice of withdrawing and splitting-open random tubes. This procedure was always of dubious value and its cost today would be prohibitive.

The Probolog is a portable, rugged instrument consisting of four major parts:

1. The probe itself, which acts as the sensing element. It contains an insulated electromagnetic pickup unit, placed in a stainless-steel housing so the element will not suffer from wear. A length of rubber-covered cable connects the pickup unit to the recorder. This cable looks for all the world like an extension cord.

2. An electronic recorder operating from 110-v ac. It has all the remaining essential electrical circuits to transfer the probe's information to a chart, Fig. 3, recording mechanism and provisions for adjustment and balance. A clock motor, synchronized with the movement of the probe through the tube, drives the strip chart.

3. A mechanical probe puller, which connects to and is operated by the recorder. This puller provides a pulley and gear shift to engage and pull the probe cable back out of the tube at two different speeds, 12 or 4 fpm. A separate probe-injection gun operating under compressed air can be obtained to "shoot" the probe into the far end of a tube.

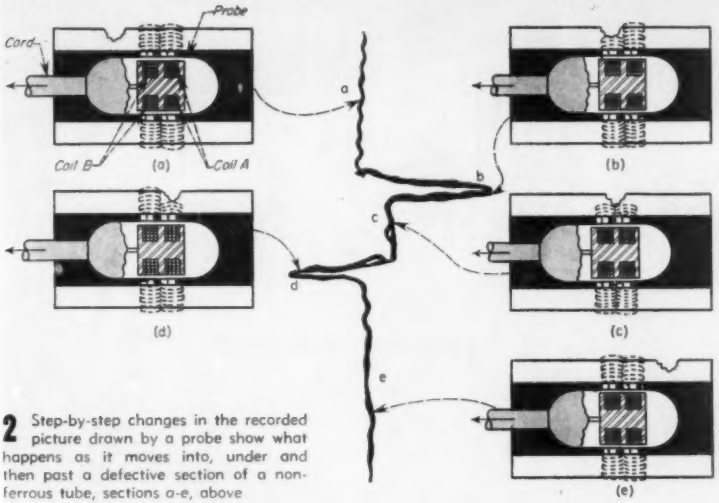
4. A tube standard to permit checking the machine's operation in the plant. The usual standard is a piece of ¾-in.-OD, 16-gage admiralty brass. It has been machined on the outside to remove 10% of its wall thickness.

Fig. 3 shows a chart record of a brass tube with a 1/16, 3/32 and a ⅛ in. hole plus two wear-areas, 10% and 50% removed. By running a probe through the standard tube this chart should be duplicated. If not, the equipment needs servicing.

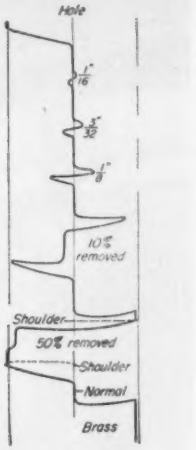
Probe Operation. Let's run through a typical Probolog check. First, you select the correct-size probe. Because the probe puts out an electrical field around it, the closer the probe size comes to the inside diameter of the tube, the

Article based on material from two sources: (1) "New Method for Inspecting Tubing Which Contains No Iron," by A T Bezverkov (from *Coal to Kilowatts*, Detroit Edison Co, August 1951); (2) *Operating Manual*, Report No. 338-1, Shell Development Co, Inc.

TRAVELS ALONG INSIDE OF TUBE, PICKS UP ALL DEFECTS, SPOTS THE POSITION



2 Step-by-step changes in the recorded picture drawn by a probe show what happens as it moves into, under and then past a defective section of a non-ferrous tube, sections a-e, above



3 Test tube with 10 and 50% worn sections shows above

more uniform the electrical field, and hence the more sensitive and accurate the picture it draws. Then you put the probe in the tube and feed it through to the opposite end. If you have a prob-injection gun (top. p 94) then you "shoot" the probe down the tube's length.

The cable cord connecting to the probe goes into the drawing wheels of the puller, Fig. 1, and you start the instrument. Depending on the puller speed, the probe moves through the tube at the rate of 12 or 4 fpm. A paper tape or chart, Fig. 3, synchronized with the probe moves at one fpm rate and records any electrical unbalance in the impedance bridge. A varying wall thickness or an actual break in the metal changes the electrical characteristics in the probe coils and these changes then show on the chart.

Fig. 2, a cutaway of the probe itself, shows schematically how these electrical changes are picked up. *A* and *B* are separate coils through which passes a 1000-cycle alternating current generated by an oscillator in the recorder unit. The two coils form the adjacent arms of an impedance bridge. The other two arms are in the recorder.

As the current flows through the coils, it sets up magnetic fields (dashed lines in Fig. 2) in the section of metal tube around the probe. In position *a*, both fields are alike because the tube section has a uniform thickness free of holes, or pit marks. With a condition like this you can adjust the instrument to zero, that is, make the knob settings on the recorder so the moving pen is in the center of the chart.

As the probe puller brings the probe to the left of position *b* so the pit in the tube is opposite coil *B*, the electrical field becomes distorted. The impedance of coil *B* drops while that of coil *A* stays the same, because the tube surface it cuts has not changed.

When the probe reaches position *c* the pit lies midway between the two coils. So the electrical field set up is not distorted but the impedance of both coils has decreased somewhat.

Moving into position *d*, coil *B* is back in a good section of tubing again and has the same impedance it had at position *a*. Coil *A*, though, is now opposite the pit and its impedance has dropped. Finally in position *e* the fields and impedances of both coils *A* and *B* are back to normal, position *a*.

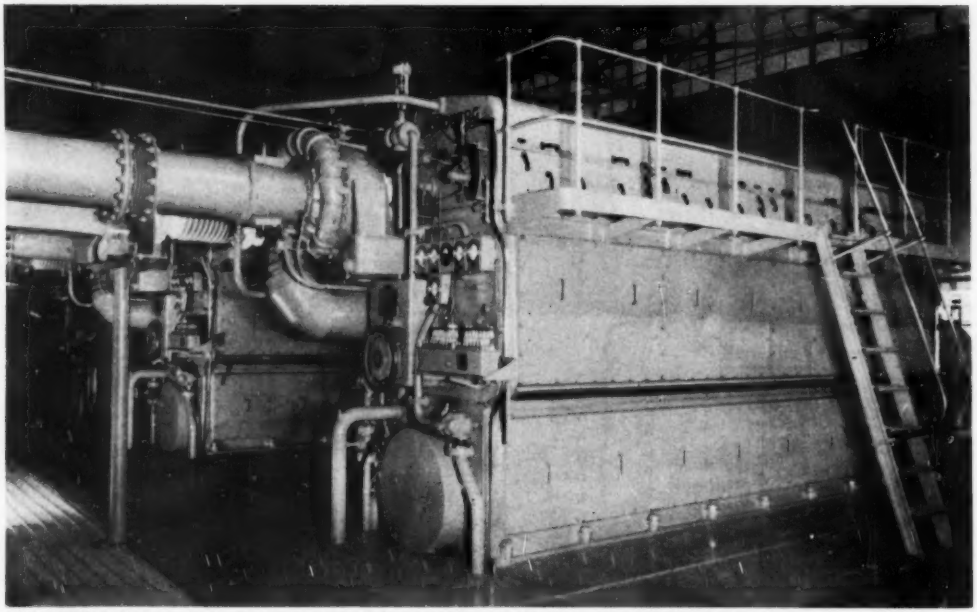
The instrument records the direction and amplitude of the impedance unbalance, Fig. 2. As the probe passes the pit in the tube, the pen first swings to one side of the chart, returns to the center, swings to the other side, and again returns to the center.

Meter Adjustments. Since tube diameter, wall thickness and material can vary from one piece of equipment to another, the instrument carries a number of adjustments. For instance, various-sized probes are furnished. As we pointed out earlier, the greatest sensitivity comes with a probe size that gives the least possible clearance between probe and inner wall of the tube.

Correct setting of the zero reading on the instrument depends on the tubes in the equipment you're testing. You insert the selected probe in a specimen of tubing that is in the "new" condition but is otherwise similar to the tubes undergoing test. Then you pull the probe through this specimen and make the necessary adjustments to get the pen tracing exactly in the middle of the chart.

For really accurate interpretation of the final chart and, for that matter, correct setting for sensitivity, you should have a specimen tube with certain tube-wall portions worn down by 10 and 50%. Then the sensitivity adjustments are fixed so the pen moves about halfway to the chart edge to denote a 50% reduction of wall thickness.

Once all adjustments are made, the job of tube testing goes fast. At Detroit Edison, the research dept does not inspect every tube in a piece of equipment. Instead, they pick a number of tubes at random. The number is large enough to make a group statistically representative of all the tubes in the equipment. An examination of the trace records and a visual inspection of defective tubes pulled out, plus some experiences from previous inspections, enable the inspector to make a good estimate of the general conditions of all tubes.



DUAL-FUEL DIESELS in Oklahoma power plant. Note air-intake duct and exhaust-driven turbocharger. Air enters through an oil-bath filter, and exhaust is vented to a vertical silencer outside of building. Fuel is natural gas and diesel pilot oil

Dual-Fuel Engines Produce Low-Cost Power for Western Electric Co-op

By **HOWARD G CROCKER**, *Project Superintendent, Western Electric Cooperative*

► A NEW 3-UNIT dual-fuel diesel plant at Woodward, Okla. is generating first power for Western Electric Cooperative's REA network, which will serve 25,000 square miles of western Oklahoma. In supplying 4615 consumers in six counties, this plant energizes 2935 miles of distribution line. Peak nightly loads of 2700 kw require operation of all three engines.

These prime movers are identical 8-cylinder, 16x22-in., 4-cycle, supercharged dual-fuel engines, each rated 1685 hp at 327 rpm. Each drives an 1100-kw 3-phase 60-cycle 4160-volt generator.

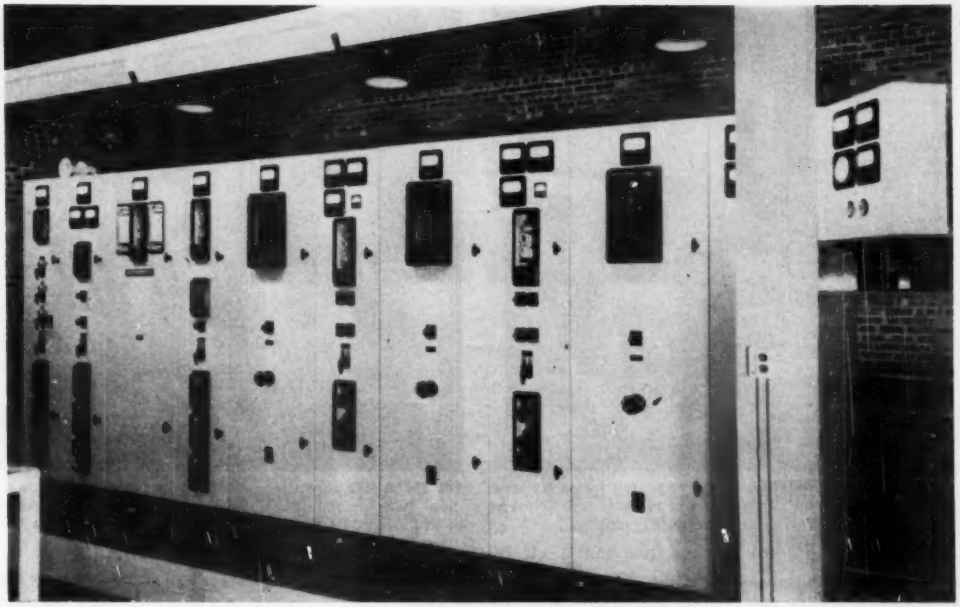
Natural gas is the primary fuel the engines use. The gas reaches the master meter at 34 psi, is reduced to 23 psi, and then goes through individual meters for each engine. Another set of regulators cuts pressure to 13 psi before the gas reaches the engine header.

No. 2 diesel oil is used to "trigger" combustion in the cylinders. This oil is stored in a 15,000-gal, vertical, cylindrical storage tank. Floats in the individual, 300-gal, elevated day tanks in engine room automatically control motor-driven transfer pumps, which move pilot oil from storage through a fuller's-earth filter to day tanks. From these tanks, oil flows through individual meters and duplex filters to the booster pumps of engines.

Great care is taken to recondition the straight mineral lubricating oil used throughout the plant. Some oil is drawn continuously from the engine's pressure lube-oil system by a motor-driven pump, put through a fuller's-earth filter, and returned to the crankcase. This filtration continues 24 hr a day, whether the engine operates or not.

Included in the pressure lube-oil circuit are a shell-and-tube oil cooler and a motor-driven auxiliary pump, which is arranged to cut in automatically if the main-engine lube-oil pump fails. Mechanical lubricators supply the cylinders with oil. A separate bag-type filter cleans the turbocharger oil.

The plant has a reclaimer for batch purification of lubricating oil. When pressure at the continuous fuller's-earth filter reaches 40 psi, oil is drained from the engine and put through the reclaimer, which eliminates not only acids, tars and solid impurities, but also fuel and water dilution. At the same time,



DEADFRONT, unit-type swtchboard holds voltage regulators, kilowatt and voltage meters, totalizing kwhr meters, engine-hour meters, reverse-current relays, and electrically operated switchboard. Board current is supplied by 120-volt battery set

Oklahoma internal-combustion plant generates power at total fuel cost of 1.96 mills per kwhr. In future, plant will help stabilize voltage, firm up hydro power, and serve as stand-by in case of transmission-line failures in co-op network

new elements are put in the continuous filter. A set of these filtration elements lasts about 2500 hr. No oil is discarded since the reclaimer puts the lube in essentially new-oil condition, and only new oil is used for makeup. Condition of the oil is checked regularly with an oil-testing kit.

Cooling-water system is highly flexible. Key unit is an induced-draft cooling tower with three cells usable either singly or in any combination. Each cell is equipped with a 2-speed fan, which can be controlled from the engine room. Three centrifugal pumps circulate water through the engines, shell-and-tube exchangers. Another set sends raw water through the exchangers, over tower. Pumps in each circuit can also be used individually or in any combination.

Jacket-water temperature is controlled automatically by thermostatic valves, which bypass raw water around the exchangers. City water for makeup is treated with chemicals to keep jacket water to 1 gr hardness and pH 8. Water is tested daily.

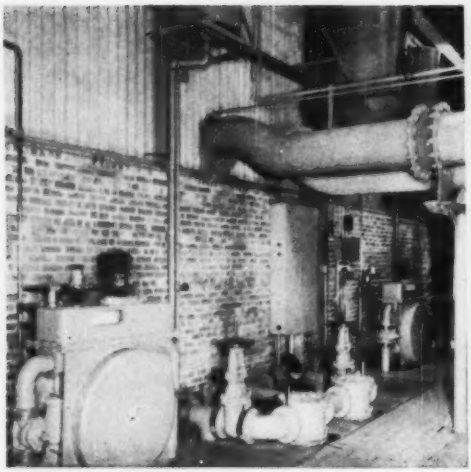
An oil-bath air filter outside the plant cleans intake air for each engine. Air is fed to the cylinders under pressure by the exhaust-driven turbochargers. Exhaust gas passes through them and vents through vertical silencers outside building.

Starting air for the engine is supplied by a pair of V-type compressors, one driven by a motor with automatic pressure control, and the other by a small gasoline engine.

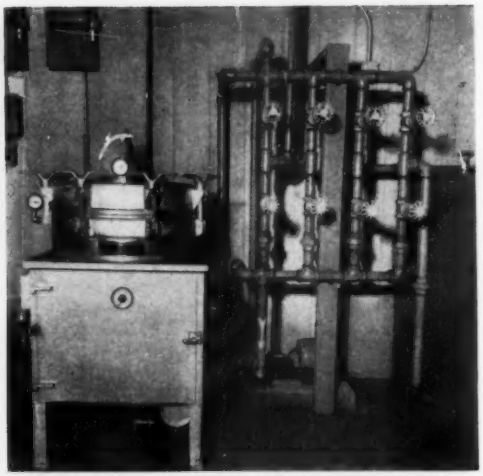
Each engine has an alarm panel with gages and alarms for jacket-water pressure and temperature, lube-oil pressure, lube temperature, turbo lube temperature, low-gas pressure, low and high day-tank level, and low fuel-oil pressure. There is also a multipoint exhaust pyrometer for each engine.

The deadfront, unit-type switchboard holds voltage regulators, kilowatt- and voltage-recording meters, totalizing kwhr meters, engine-hour meters, reverse-current relays, and electrically operated switchgear. A 120-volt battery set provides current for the switchboard and for emergency plant lighting. A rectifier keeps the batteries charged.

This plant was first put on the line April 12, 1950. In the first full six months of operation, from May through October, the engines produced 4,062,000



INDIVIDUAL GAS METERS, pressure regulators for each engine. Pressure reduced from 34 psi on line to 13 psi for use at header



OIL RECLAIMER containing heat exchanger, preheater, vacuum-draw fuller's-earth filter, vaporizer, and circulation pumps

kwhr. Also the dual-fuel units consumed 43,502 mcf of natural gas (average of 10.71 cu ft) and 30,736 gal of pilot oil (average of 0.00756 gal per kwhr). Later, individual months showed greater efficiency with gas consumption going to 10.02 cu ft and pilot oil to 0.0061 gal per kwhr.

On the basis of 12.5-13.0c per mcf and 7.9c per gal, fuel costs were $5569 for gas and $2411 for oil for the 4,062,000 kwhr. In cost per kwhr this is 1.37 mills for gas and 0.59 mills for oil, a total of 1.96 mills per kwhr.

In operating 6570 hr, the engines used 1306 gal of lubricating oil, an average of 8476 rated hp-hr per gal of lube consumed.

This plant is one of a power-producing combine of eleven REA cooperatives serving Oklahoma from Oklahoma City west to the panhandle. With a $12.5 million loan from REA, Western Electric is building a 30,000-kw steam plant at Anadarko and 877 miles of 69,000-volt transmission line to link up member cooperatives.

Southern Power Administration will operate these lines and will also build a 138,000-volt line linking the Anadarko steam plant to the hydro power of Denison dam at Lake Texoma. The role of internal-combustion engines will be to stabilize voltage, firm up hydro power, and provide insurance against outages during transmission-line failures.

PRINCIPAL POWER-PLANT EQUIPMENT

Western Electric Cooperative, Woodward, Okla. Plant

Engines, 3	Nordberg Mfg Co
1685-hp, 8-cylinder, 16x22-in., 4-cycle, 327-rpm, supercharged Duafuel engines	
Generators, 3	The Elliott Co
1100-kw 3-phase 60-cycle 4160-volt	
Injection system	Scintilla Magneto Div, Bendix Aviation Corp
Governors	Woodward Governor Co
Fuel-unloading pumps	Geo D Roper Corp
Fuel-transfer pumps	Haight Co
Fuel meters	Buffalo Meter Co
Fuel booster pumps	Tuthill Pump Co
Fuel filter	Wm W Nugent & Co, Inc
Fuel purifier	The Hilliard Corp
Gas meters	Pittsburg Equitable Meter Co
Gas regulator	Pittsburg Equitable Meter Co
Lube oil	Cities Service Oil Co
Cylinder lubricators	Manzel Inc
Auxiliary lube pumps	Blackmer Pump Co
Lube-oil purifiers	The Hilliard Corp
Lube-oil coolers	Ross Heater & Mfg Co, Inc
Cooling tower, induced draft	J F Pritchard & Co
Water-purification chemicals	National Aluminate Corp
Air filters	American Air Filter Co
Exhaust silencers	Maxim Silencer Co
Switchboard	Westinghouse Electric Corp
Pyrometers	Illinois Testing Laboratories Inc
Voltage regulator	Westinghouse Electric Corp
Batteries	Electric Storage Battery Co
Rectifier	Westinghouse Electric Corp
Alarm panels	Viking Pump Co
Circuit breakers	General Electric Co
Air compressors	Gardner Denver Co
Level meters on day tanks	Rochester Mfg Co, Inc
Lube-oil reclaimer	The Hilliard Corp
Water pumps	Dayton-Dowd Co
Thermo regulators	Fulton Sylphon Div, Robertshaw-Fulton Controls Co
Heat exchangers	Ross Heater & Mfg Co, Inc
Engineers	C H Guernsey & Co
Construction supervisor	Howard Crocker

Our Defense Program Faces a Crisis

A major crisis will soon confront our defense program.

It is not a crisis in raw materials. To find enough materials, from steel to cobalt, for defense production is a serious problem. But it is one that is being solved.

It is not a crisis in manpower. Shortages of workers with special skills hamper production, but these shortages are being relieved, slowly.

It is not a crisis in manufacturing capacity. American industry's record-breaking expansion is, with very few exceptions, keeping abreast of defense needs.

The coming crisis will be one of finance. It will rise from our failure to provide the means to PAY FOR the defense program we now have under way.

A $15 Billion Deficit?

Congress has approved a defense program which is scheduled to raise *total* federal spending in the year from June, 1952, to June, 1953, to somewhere between $85 and $90 billion. Additional appropriations for more air power and atomic development, which are now proposed, would add several billion dollars.

But Congress has not approved a tax plan to match such spending. With the new levies enacted in this session, tax collections during the 1952-53 fiscal year are estimated to fall somewhere between $70 and $75 billion. That would be roughly $15 billion short of balancing the budget. If the defense program is expanded, the deficit will be that much greater.

We have not yet felt the impact of the crisis that would accompany a federal deficit of this magnitude. Federal tax collections currently are big enough to balance federal expenditures. But the defense program is scheduled to boost the annual rate of federal expenditures $25 billion in the next year.

To Meet the Crisis

By January the crisis will be clearly in sight.

Then the President will present his budget. After that, Congress must act to close the broad gap between government income and government spending. If it fails to do that, the whole defense program will be menaced by weakness in its financial foundations. That weakness might well take the form of another destructive wave of inflation.

We have three ways to meet this crisis.

The best approach, of course, is to cut unessential expenditures. That can make a real dent in the deficit. The second is to collect more

taxes. The third, and by all odds the most dangerous, is to have the federal government meet its deficit by going deeper into debt. Borrowing, which might feed inflation, can easily lead to disaster.

Near Income Tax Limits

It will not be possible to raise taxes to meet the deficit merely by increasing further the rates on corporations and on persons in the upper income brackets. Congress has about scraped the bottom of that barrel.

The Senate Finance Committee said as much in reporting this year's tax bill. The Committee reported that it had "serious doubts as to the feasibility of raising any substantial additional amounts of revenue from income tax sources." The Committee observed that recent tax legislation brings the burdens of most corporate and individual income taxpayers close to the World War II peaks, and actually carries the rates paid by many taxpayers above those peaks.

Our ramshackle federal tax system must be thoroughly overhauled in order to broaden the tax base if it is to produce more revenue—without doing much more harm than good.

The shocking fact is that no one seems ready to act along any line that might enable us to surmount the crisis.

That fact of itself aggravates the coming crisis. And next year's presidential election doesn't make it any easier to move effectively. Both parties will shrink even more than normally from backing any program that might irritate any considerable number of voters.

If we are to meet this crisis on the tax front in an orderly way, the technical work should be in progress right now. To a large extent it is being ignored.

If we are to enforce the vitally essential program of government economy, there is the same urgent need to get under way the spade work that is required.

And if—as a last miserable expedient—we decide to let the federal government drift deeper into debt, it must have a well-developed program of borrowing from individuals and other investors, such as insurance companies, rather than from the commercial banks. Borrowing from commercial banks might speedily translate the deficit into more and more price inflation. No adequate program of borrowing from savings is now in sight.

Now Is the Time

It is possible, of course, that international relations may improve sufficiently to make it safe for us to slow down the rearmament program. If that should happen, the fiscal crisis would not be so critical. But that kind of good fortune has been notably absent in recent years.

Lenin, patron saint of Communism, is quoted to the effect that to destroy a political and social system such as ours "you must debauch its money."

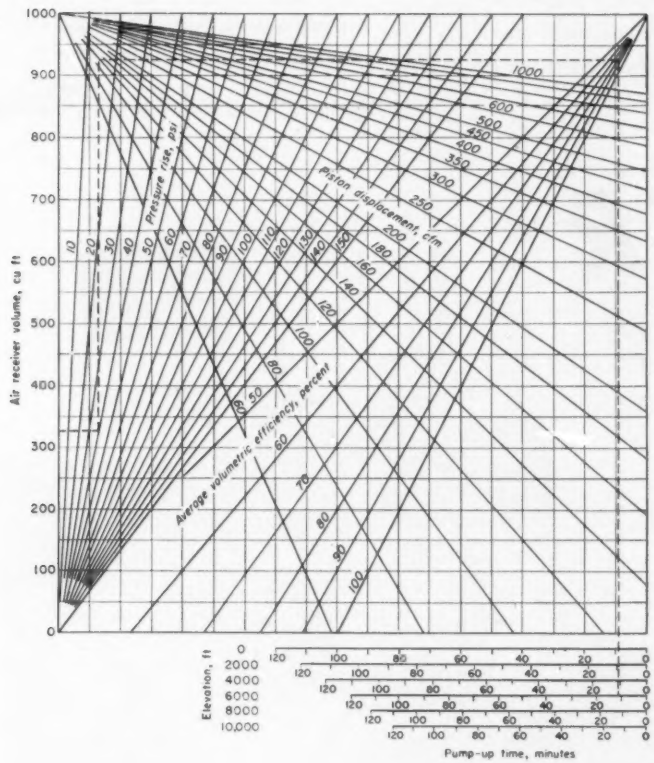
We shall set democracy to digging its own grave if, through our preoccupation with politics during the presidential campaign, we pave the way for further debauchery of our money.

If we really want to avert that disaster, now is the time for us to get going.

Once the crisis is full upon us, it will be too late.

McGraw-Hill Publishing Company, Inc.

POWER DATA SHEET



Air Receiver Pump-Up Time

► THIS CHART gives an estimate of time needed to pump up air receivers of different capacities, pressures and altitudes with compressors of different volumetric efficiencies. Chart is based on the formula that is given below:

$$T = \frac{V(P_1 - P_2)}{14.7DE}$$

T = pump-up time, minutes
V = receiver volume, cubic feet
P_1 = final receiver pressure, psia
P_2 = initial receiver pressure, psia
D = compressor piston displacement, cfm
E = compressor average volumetric efficiency, %/100

This formula applies to sea-level or zero altitude. For higher altitudes the time for zero level is multiplied by the ratio of atmospheric pressures at sea level to that of the actual altitude. This is automatically done by the family of scales in the lower right corner of the chart. Simply read your answer on the scale corresponding to the elevation of the installation.

Example: An air-compressor installation at 6000-ft altitude has a receiver volume of 325 cu ft. Compressor piston-displacement rate runs at 120 cfm and average volumetric efficiency equals 80%. Find the compressor pump-up time when initial receiver pressure stands at 25 psig and normal working pressure is 65 psig.

Pressure rise = 65–25 = 40 psi. Enter chart at 325 cu ft on left-hand scale. Follow trace horizontally to 40-psi pressure rise, turn vertically to 120 cfm piston displacement, turn right to 80% volumetric efficiency, and then down to the 6000-ft elevation scale to find the answer of 11.5 minutes. Note this corresponds to 9 minutes for a sea-level location.

Example: What receiver capacity is needed for a 200-cfm piston-displacement compressor operating at 80% average volumetric efficiency when pressure rise from atmospheric pressure to working conditions is 150 psi and pump-up time is not less than one hour? Installation is at sea level.

Enter chart on zero elevation scale at 60 min, to intersection with 80% volumetric efficiency, then right to 200-cfm displacement. Turn vertically up to 150-psi pressure rise, then left to read answer of 945 cu ft receiver volume on left-hand scale.

To extend the chart range, when displacement is greater than 1000 cfm, solve the problem using 1000 cfm; divide the answer by ratio of actual displacement to 1000 cfm. When pressure rise is greater than chart maximum, use rise equal to one-half or one-quarter actual value and multiply chart answer by two or four.

T G HICKS, *Assistant Editor*

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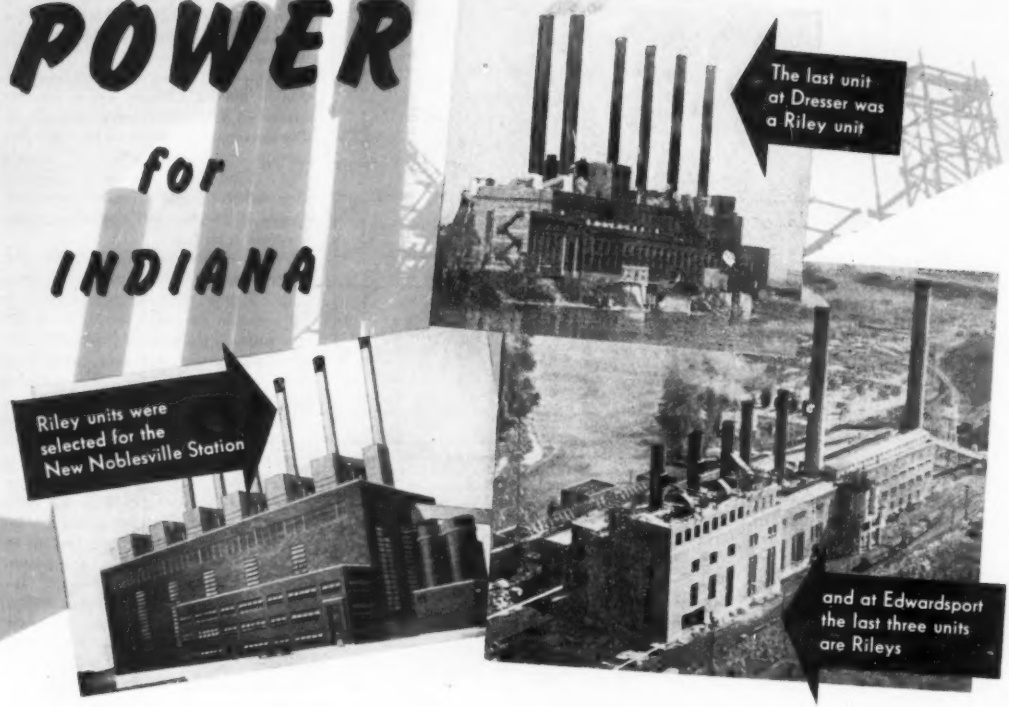
Public Service

Company of Indiana, Inc.

Public Service Co. of Indiana by continuous expansion of their generating facilities has provided stacks and stacks of power for Indiana. Riley is proud to have had such a large part in their expansion programs.

You Can Rely on Riley


The last unit at Dresser was a Riley unit
Riley units were selected for the New Noblesville Station
and at Edwardsport the last three units are Rileys

RILEY

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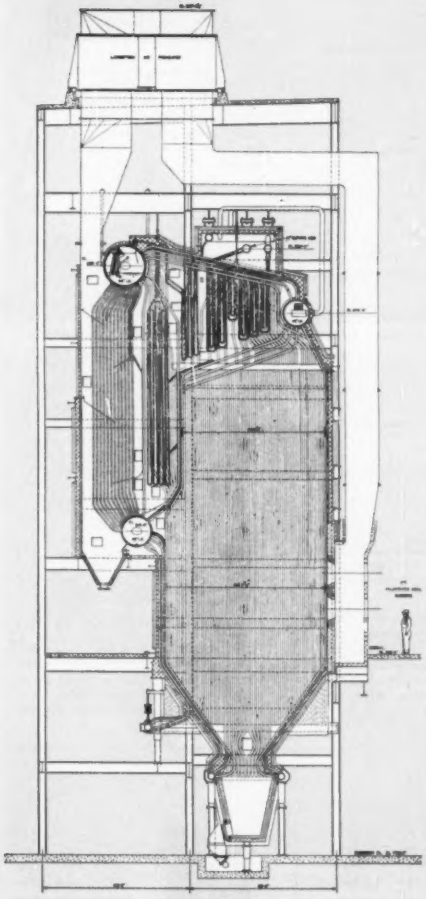
Installed 7 Riley Units Since 1947



PUBLIC SERVICE COMPANY OF INDIANA
NOBLESVILLE STATION
3—300,000 lbs./hr. Riley Units
1025 psig—950°F. Temperature

Public Service Company of Indiana Selected Riley Steam Generating Units for their latest additions to Dresser and Edwardsport Stations and also for their new Noblesville Station. Sargent and Lundy were Consulting Engineers.

Riley History of Public Service Co. of Indiana

First Order—July-1946
1—300,000 lbs./hr. Riley Unit for Dresser Station

Second Order—Sept.-1946
2—400,000 lbs./hr. Riley Units for Edwardsport Station

Third Order—July-1947
3—300,000 lbs./hr. Riley Units for Noblesville Station

Fourth Order—March-1949
Another 400,000 lbs./hr. Riley Unit for Edwardsport Station

Total 4 orders—7 Units—Total Capacity 2,400,000 lbs./hr.

All of these Public Utilities have Purchased Riley Steam Generating Units.

Monongahela Power Co.
Houston Lighting & Power Co.
Iowa Electric Light & Power Co.
Utah Power & Light Co.
S. Carolina Elec. & Gas Co.
Union Electric Co. of Illinois
Southwestern Public Service Co.
New Orleans Public Service Co.
Gulf Power Co.
Florida Power & Light Co.
Ohio Edison Co.
Southern Ind. Gas & Elec. Co.
Interstate Power Co.
Upper Michigan Power & Light Co.
Central Ohio Light & Power Co.
Natrona Power & Light Co.
Cambridge Electric Light Co.
West. Colorado Power Co.
Newport Electric Co.
Northwestern Public Service Co.
S. Carolina Public Service Authority
The Potomac Edison Co.
Northern States Power Co.
Arkansas Power & Light Co.
Central Illinois Light Co.
Public Service of Indiana
Northern Virginia Power Co.
Carolina Power & Light Co.
Worcester County Electric Co.
Penn. Electric Co.
Iowa-Illinois Gas & Electric Co.
Mississippi Power Co.
Lynn Gas & Electric Co.
West Penn. Power Co.
Superior Water, Light & Power Co.
Ottertail Power Co.
Cliffs Power & Light Co.
Washington Water Power Co.
Iowa Public Service Co.
N. Dakota Power & Light Co.
Missouri Utilities Co.
City of Los Angeles Water & Power

It will pay you to consider Riley equipment because Riley gives you more for your money.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

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Full length outlets permit fast lining up and ample room for rod manipulation; keep high welding heat away from vital crotch zones.

Uniform Wall Thickness

Uniform wall thickness at all points permits perfect lineup with pipe, O.D. and I.D. No thinning of long outer wall . . . no thickening of short inner wall. Complies with code requirements.

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True circular section at all points makes fitting easy to align and weld . . . no distortion or flattening to affect flow adversely.

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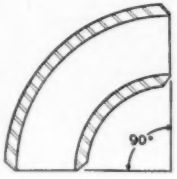
Accurate bevels aid aligning and welding. Standard straight bevel for thickness (T) 3/16 to 3/4 inch inclusive. Standard U-bevel for thickness (T) greater than 3/4 inch.



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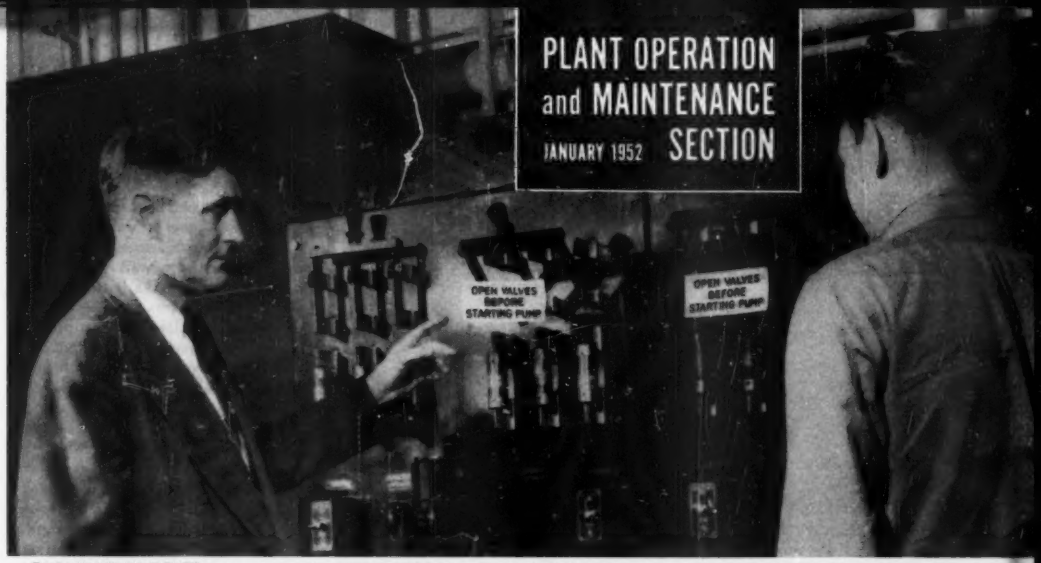
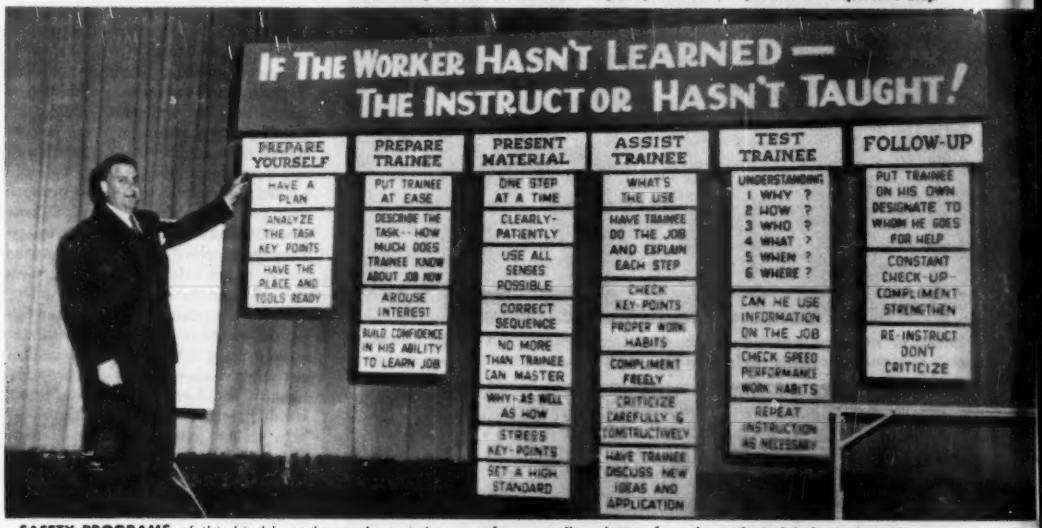


TAG PUMP SWITCHES so pump won't be wrecked by closed valve. Bill Davis, left, shows this operator an important step


IF THE WORKER HASN'T LEARNED —
THE INSTRUCTOR HASN'T TAUGHT!
PREPARE YOURSELF
HAVE A PLAN
ANALYZE THE TASK KEY POINTS
HAVE THE PLACE AND TOOLS READY
PREPARE TRAINEE
PUT TRAINEE AT EASE
DESCRIBE THE TASK -- HOW MUCH DOES TRAINEE KNOW ABOUT JOB NOW
AROUSE INTEREST
BUILD CONFIDENCE IN HIS ABILITY TO LEARN JOB
PRESENT MATERIAL
ONE STEP AT A TIME
CLEARLY-PATIENTLY
USE ALL SENSES POSSIBLE
CORRECT SEQUENCE
NO MORE THAN TRAINEE CAN MASTER
WHY-AS WELL AS HOW
STRESS KEY-POINTS
SET A HIGH STANDARD
ASSIST TRAINEE
WHAT'S THE USE
HAVE TRAINEE DO THE JOB AND EXPLAIN EACH STEP
CHECK KEY-POINTS
PROPER WORK HABITS
COMPLIMENT FREELY
CRITICIZE CAREFULLY & CONSTRUCTIVELY
HAVE TRAINEE DISCUSS NEW IDEAS AND APPLICATION
TEST TRAINEE
UNDERSTANDING
1 WHY ?
2 HOW ?
3 WHO ?
4 WHAT ?
5 WHEN ?
6 WHERE ?
CAN HE USE INFORMATION ON THE JOB
CHECK SPEED PERFORMANCE WORK HABITS
REPEAT INSTRUCTION AS NECESSARY
FOLLOW-UP
PUT TRAINEE ON HIS OWN DESIGNATE TO WHOM HE GOES FOR HELP
CONSTANT CHECK-UP-COMPLIMENT STRENGTHEN
RE-INSTRUCT DON'T CRITICIZE

SAFETY PROGRAMS of this kind keep large plants twice as safe as smaller plants, from loss of vital help and production

You must have a plant safety program to...

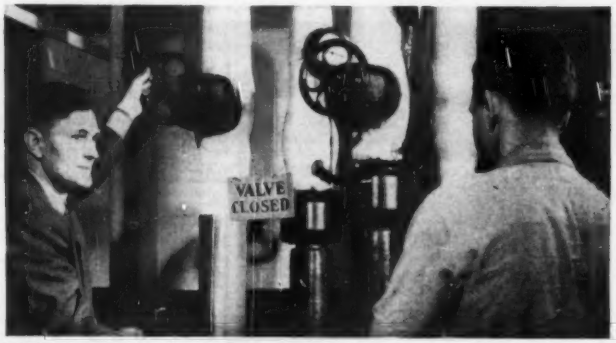
PREVENT ACCIDENTS

By **BILL DAVIS**, *National Safety Council*

► THE ENGINEER of a small paper mill with a 150-hp engine noticed that the governor belt was about to break. Instead of shutting down to fix it, he blocked the governor trip and started repairing the belt with full load on the engine.

Suddenly the engine speeded up. The engineer rushed for the throttle. But he was too late because the flywheel exploded and killed him instantly. The engine was wrecked and so the engine room was damaged. The plant shut down for weeks, until a new engine was installed—all because the unlicensed en-

BRIEFING OPERATORS in safety before starting up a new piece of equipment is the chief engineer's responsibility. That's one sure way to prevent costly accidents



TAGGING important valves, such as pump-discharge, prevents machinery damage and also personnel being injured from blown gaskets, ruptured machinery casings, etc

CHECK TOOL POST on grinders for one-eighth-inch clearance. Also see that guards are installed properly and not defective through years of constant use and abuse

SAFETY IS A FULL-

gineer was not taught safety for his job.

Needless to say, it was easy to sell this plant's top management a safety program. But why wait for a major disaster? Why lock the barn after your horse is stolen?

Should your plant's safety program include your power-plant engineers? The answer is yes! Why? Because the power plant is the heart, or mainspring, of any manufacturing plant.

Do power-plant engineers take part in their plant's safety program? We know that large power plants (ones with over 20,000-lb-per-hr steaming capacity, or more than 100 employes) do include the power plant in safety program.

Small Plant Dangerous. The National Safety Council has made detailed studies of the accident frequency rate in smaller plants. We find this rate is 47% *greater* than in larger plants.

The power-plant operator should be the most safety-conscious person in any occupation. Almost everything he operates is guarded with safety devices. The boilers have safety valves; air compressors have over-pressure relief valves and cutouts; electric motors are equipped with overload relays and fuses. These should indicate the necessity for safety. They are reminders to be safety conscious, to act safely in the plant, when driving a car, or at home.

Power engineers should know the factor of safety of their equipment. In well-operated plants, they frequently test safety devices for working properly. Usually, accidents with this equipment are due to the human element.

In larger power plants, the safety program includes the power operator. Every new employe in large power plants is usually taught safe operation of his equipment. He's also trained in general plant-safety practices.

No Training. In smaller power plants, the new employe is taken for granted. It's *assumed* he knows how to operate correctly. If there is a safety program, it usually does not include the power-plant operator.

Tough Job. It's hard to sell a safety program to top management of smaller plants. They assume their engineers and operating staff are competent and safety conscious.

I've talked to managers of many small plants. Usually they say, "We have never had an accident in our powerhouse and don't expect one. Besides we're covered by insurance. An accident-prevention program costs money."

Insurance Doesn't Pay All. In a study

TIME JOB FOR ALL

conducted by several competent safety engineers, every accident was found to cost $4 in lost output, overhead and training replacements, for every $1 spent in such direct costs as medical bills and compensation insurance.

These hidden costs are seldom carried in a company's books as a loss tied up with accidents. They are present in over-all cost of power-plant operation. Hidden costs include (1) damage to machinery (2) damage to equipment (3) loss of productivity from damaged machinery (4) loss of skilled employes (5) cost of finding and training replacements (6) time lost by the injured and by other employes through curiosity and sympathy, or aid to the injured (7) time lost by management in giving aid, investigating the accident, and preparing insurance and state report forms of the accident.

In these days of higher operating costs, the figure of $4 to $1 is conservative. To operate a power plant profitably, eliminate these indirect operating costs by an accident-prevention program.

Accident prevention is not easily sold to top management even after production is lost through machinery and equipment damaged. The same goes for physical and financial victims of accidents.

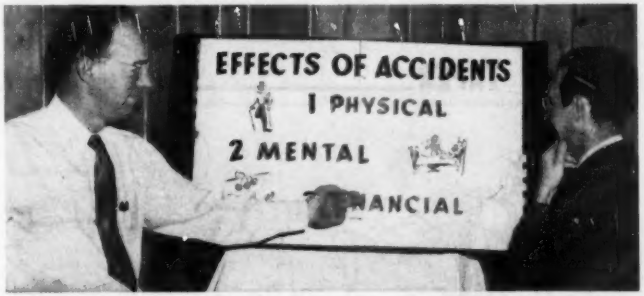
Starting Program. What are the things to do in starting a well-rounded safety program? First, someone must assume responsibility and supervise program. Many smaller plants cannot justify a full-time safety director. So management must select a responsible head, who is well respected.

If plant manager can't assume duties, why not give them to the power-plant engineer? His first job is to make a thorough study of safety-program methods. That includes health and physical condition of employes, and safety guards around all machinery in the entire plant and powerhouse.

Second step is to make plant a safe place to work: (1) Properly guard all machinery. (2) Inspect and place in working order all safety devices. (3) Repair all electrical apparatus for safe operation by employes and guard against fire hazard. (4) Study materials-handling problems so you have a safe, easy flow of materials through plant. (5) Have good housekeeping in plant.

Nothing breaks down morale of accident-prevention program or workers' safety consciousness quicker than poor housekeeping. Housekeeping in power plants prevents accidents, and pays off in more economical over-all operation.

FIRE DOORS must be free to close at all times. It's the foreman's responsibility to see that all doors in his department are working and that his men know why



TRAINING-COURSE material like this helps put over safety program. Here Safety Director Gerard Griffin goes over material with superintendent of Dravo Corp

Set up a safety committee to represent all employes. Choose representatives from power plant and each department. Take them from supervisory staff as well as employe personnel. Thoroughly indoctrinate safety committee with idea of accident prevention and teach fundamental steps of safety.

Set up a system of records so safety committee has ready reference to work that has been done. This committee and power and maintenance engineers must make periodic surveys of plant to see everything is safe.

Supervisory staff and foremen must know safety program and be sold on it. Impress each foreman with his responsibility for employes' safety in his department.

Training Employes. Last is education of employes themselves. Keep hammering away at safety until it finally becomes a habit with everyone. Make each person so safety conscious that he takes his safety habits home to his family and uses them in his everyday life. Educating new employes is easy. With older employes it's often harder, but an old dog *can* be taught new tricks.

Visual aids in power-plant safety program are very useful. Post new posters. Use slide, sound and motion-picture films at every gathering. Show a sound slide film or a picture during the lunch hour, at least once a month. Teach foremen new ideas from safetygraphs developed by the National Safety Council.

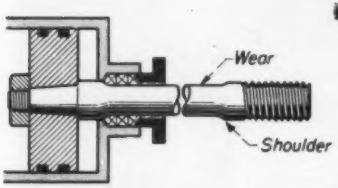
There's no magic formula to reduce accidents. When management realizes this, they will go along to prevent unnecessary high accident rates in smaller plants. Right now is a good time to start.

With labor and equipment getting critical as the cold war progresses, a safety program will pay good returns.

OPERATORS' NOTEBOOK 49

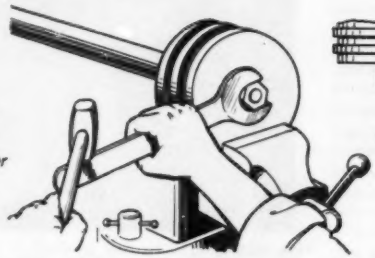
Today It Pays to Make

WEAR



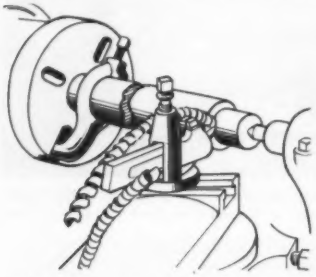
ALL RODS WEAR from reciprocating in stuffing box. Shoulders wedge through the packing, making sealing a tough job

REMOVING PISTON

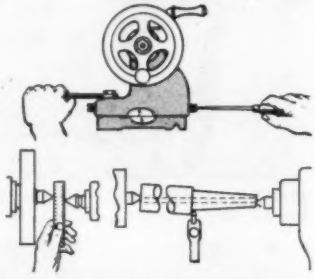


FIRST STEP in removing old rod is to clamp piston in vise. (Never clamp rod in vise.) Loosen nut one turn only. Then smack piston and rod assembly down hard against wooden plank. Nut protects threads and keeps rod from digging into wood

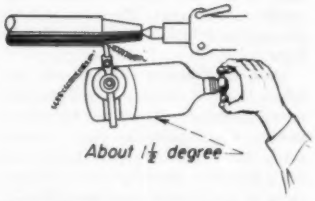
CUTTING TAPER



TURN DOWN shaft's end for small thread diameter, after both ends are centered and held between centers with lathe dog

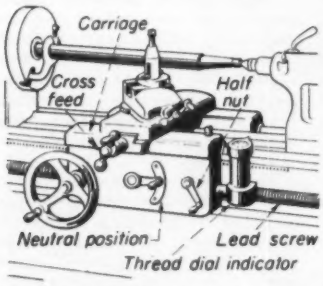


MOVING TAILSTOCK half of total taper is one way to cut. Loosen setscrews, and nut, then jack over distance needed

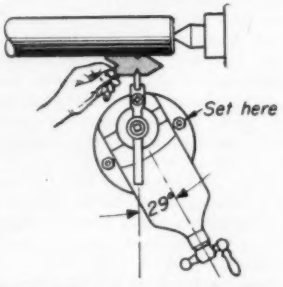


COMPOUND REST is handy for cutting short tapers. Find right angle from the old taper, then feed the tool by hand

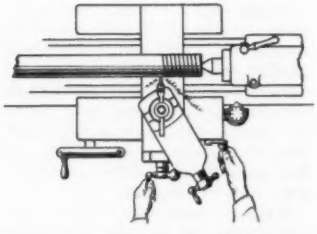
CUTTING THREADS



SET GEARS for right thread, place feed change lever in neutral, engage thread dial indicator against the lead screw



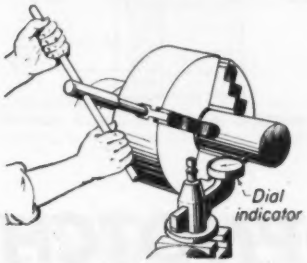
GRIND TOOL to 60 degrees to fit center gage. Place gage against straight shaft and set compound rest to 29 degrees. Cut thread by throwing in half-nut lever at any line on dial (for even threads). Draw the tool away at end with cross feed



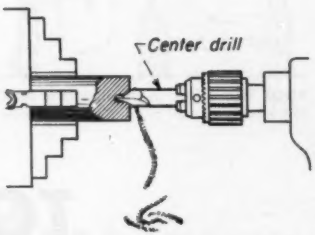
New Piston Rods

By STEVE ELONKA *Associate Editor*

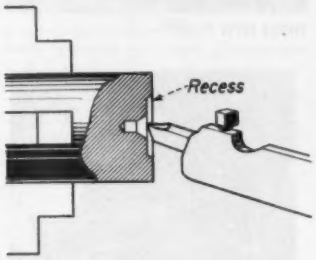
CENTERING



TRUE new shaft with dial indicator by loosening and tightening the chuck jaws until dial needle shows zero all around

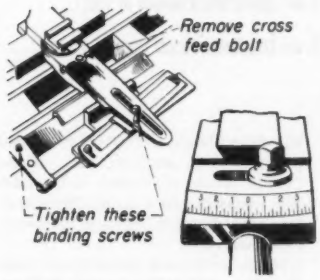


NEXT, run center drill against end of shaft slowly or drill tip will break. Be sure to oil the drill before using it

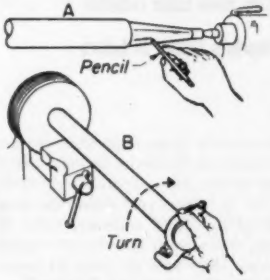


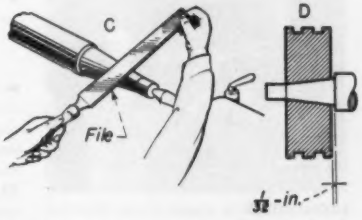
RECESS around center with lathe tool to protect center-hole edge from damage. Shaft will then be true between centers

FITTING

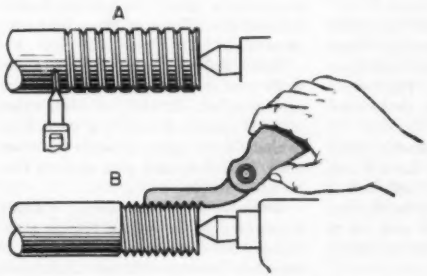


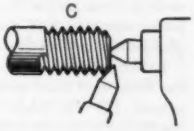
TAPER ATTACHMENT is the third method. Remove cross feed screw, tighten screws shown. Adjust to right inches-per-ft



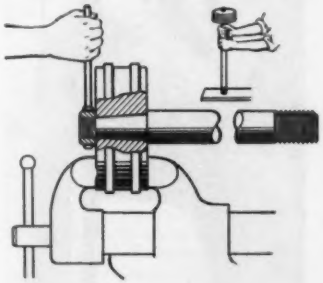


NEVER FINISH taper with lathe tool only. *A:* First mark taper with pencil. *B:* Then insert taper into position and turn quarter turn. *C:* File end with fine mill file where the pencil marks are rubbed off the taper. *D:* Shoulder should not touch the piston

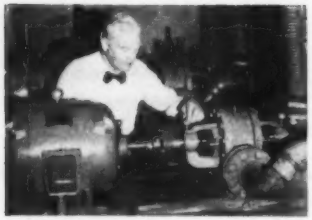




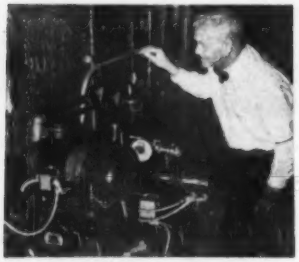
RUN CARRIAGE back by hand. *A:* Feed tool in desired amount by compound rest only Always use cross feed to remove tool and return to same point. *B:* Check threads with gage. *C:* Cut chamfer at end by placing the tool at an angle, as shown here



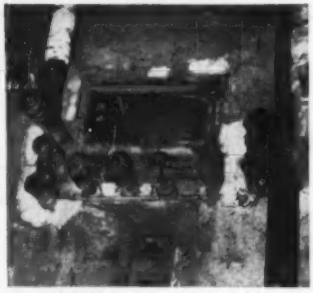
BUMP PISTON onto new rod against wood. Then tighten nut. Perfect taper will hold piston on without loading thread



THREE NEW PUMPS replace the old steam reciprocating units for pumping water

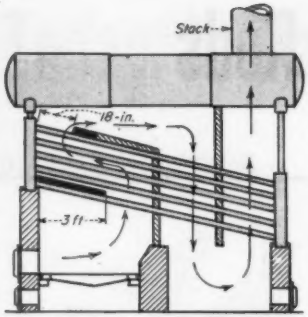


NEW OIL BURNER for heavy fuel is checked by Chief Engineer John Kerlin

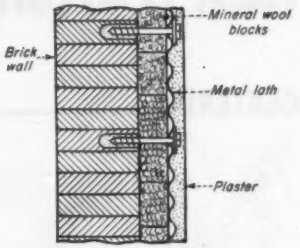


ECONOMIZER is made of ten standard pipes with fittings. It is in third pass

FIREMAN PAINTS insulated boilers, all piping and boiler room sparkling white



ROOF TILE baffles in the first pass send hot gases around more tube area now



MINERAL WOOL insulation is fastened to the boiler brick walls with lag-screws

TOPNOTCH

. . . Makes hotel plant pay

- **Cuts down boiler radiation**
- **Improves baffles in boilers**
- **Saves $85 a month in fuel**
- **Overhauls steam traps**

► SHIPSHAPE is the impression you get when you visit the boiler and machinery rooms of the Stacy Trent Hotel, Trenton, N. J. Once you shake the firm hand of her chief engineer, John W Kerlin, it's easy to see why this plant sparkles. But let's go back 21 years when Chief Kerlin first took over.

Old Plant. At that time, the two Keeler watertube boilers, of 200 hp, burned coal. The boiler room was hot and dirty. "I don't care how you do it," complained the manager. "But I want you to clean this place up and *cool it down.*"

He showed the new chief the lobby and office floors above the boilers. Three layers of rugs didn't keep heat from coming through the floor. The switchboard operator and room clerks complained about "hot feet."

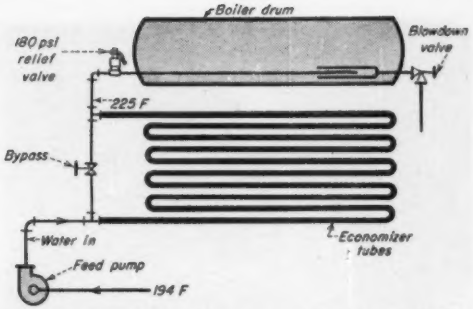
Kerlin placed a thermometer under the floor on a cold winter day. It registered 120 F. Then he attached a thermometer to the boiler's brick sides with electrician's putty. It shot up to 400 F at the first pass. Next two passes were also hot.

Insulation. To stop radiation, he lagged the two boilers with mineral wool. At first pass and top, he used 2-in.-thick blocks; 1½-in. at second pass and 1-in. at third pass. These 7x14-in. blocks were stuck to the sides with paper-hanger's paste, then small lag screws fastened blocks to brickwork permanently.

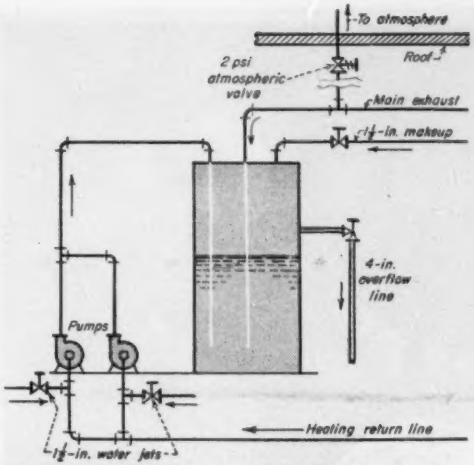
He covered doors on back and front of boilers with three layers of ⅛-in. asbestos sheets. Sheets were held on with metal lath, bolted to doors with ¼-in. screws. Metal lath was then plastered smoothly for finished job. Cost of material and labor was about $650 per boiler. After that, 109 F was highest temperature above boilers on hottest summer day. The manager removed the extra rugs.

Boiler Baffles. Next he built a 3-ft baffle over the first pass above fire generating tubes. He also cut down upper roof-tile opening from 3 ft to 18 in. That caused the hot gases to wash the tubes more completely and give up more heat to water inside.

Economizer. From 2-in. 9-ft-long standard pipe, he built a 10-pipe economizer. Economizer is in third pass to take heat from gases before discharging up the stack. After that, 194-F feedwater entered steam drum at 225 F. Stack-gas temperature came down from



ECONOMIZER TUBES placed in the third pass of all three boilers raised the feedwater temperature from about 194 to 225 F



WATER WASTE was cut down by repairing 100 radiator steam traps. Before, this open feed heater acted as a condenser

ENGINEER . . .

with these money-saving improvements

- **Cuts makeup water 80%**
- **Converts to fuel oil**
- **Installs new return heating system**
- **Converts from high to low pressure**

about 470 to 400 F. After these boiler changes went in, coal-bill savings averaged $85 a month.

Open Heater. Kerlin noticed that the open feed heater overflowed water continually from a 4-in. line. He found two 1½-in. water jets shooting water into the heating-system return pumps. The reason? The 5-psi atmospheric relief valve near the roof was rusted shut. And about 100 of the 294 steam traps on radiators throughout the hotel had their guts torn out. That caused the steam to short-circuit through the radiators and hurry back to the open feed heater. With all that steam coming back, the water jets had been installed to condense the steam. The 1½-in. makeup line was also wide open to help cool the heater. Actually, the heater acted as a condenser, with excess water overflowing to the sewer.

With new guts placed in the steam traps, and atmospheric valve freed so it could work, water consumption was cut 80%. Instead of two boilers needed to keep up steam in winter, both going full blast, one boiler carried the load nicely. So one fireman was relieved for cleaning up the plant, and for helping with repairs around the machinery.

Engine Goes. As coal went up gradually from $4 to $12.90 a ton for ordinary run-of-mine, the utility firm's proposition became a good investment a few years ago. So the old 300-kw steam engine was sold. That meant doing away with steam pumps.

The chief installed a new vacuum condensate-return system with electric motors. He replaced the two simplex pumps, supplying the roof fresh-water tank, with two electric-driven impeller-type pumps of 250 gpm. (These pumps take suction from the large float-controlled surge tank.) A third standby electric-driven pump of 80 gpm was also installed.

Then the boilers were rebricked with a checkboard floor for oil burning. Burners are rotary, wide-range and carry all loads without changing burner tips. They burn the cheapest No. 6 heavy oil. A large 15,000-gal storage tank is housed in the coal bunkers.

Boiler pressure was reduced from 160 to 15 psi. Because the system is now automatic and pressure is low, only one fireman is needed on a watch.

Cleaning Up. After this system was completed, Kerlin decided to do some real house cleaning. He put his fireman up on ladders and gave them hoses to wash everything in the old coal-dust-soaked boiler and machinery room. That took weeks.

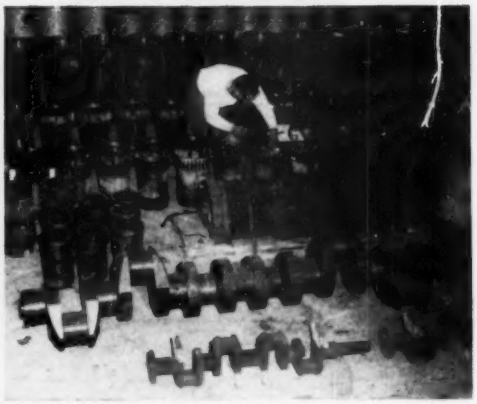
Now after more weeks, ceilings, walls and boilers are being painted white. All brass and copper tubing is shined and the place sparkles like a ship's engine room.

Background. Have you been wondering what it takes to get a chief engineer of Kerlin's caliber? Well, at 16 he started learning the plumber's trade.

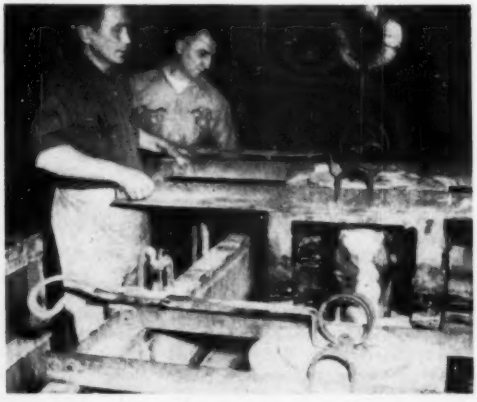
Next, he worked in shipyard for six years. Nine years of installing ice machinery all over the country followed. Then four years as assistant chief for Swift Packing Co. Three years as chief engineer in a rubber-reclaiming plant. After that, 2½ years as master mechanic in a central power station. Then 2½ years as third and second assistant engineer aboard merchant ships satisfied his wanderlust.

Today, 54 years young, Chief Kerlin has settled down to running a smooth plant. It's smooth because he made it that way. He converted to the present low-pressure heating system with bought power only when figures showed that he could run the plant more efficiently.

Dr **HENDRIK VAN DER HORST,** president and founder of firm, inspects large liner's bore before it is reconditioned. His process stepped up combat efficiency of military engines during last war. Today, this work is more vital than ever



RECEIVED PARTS arrive daily from all parts of country. Instead of going to scrap pile, these cylinders and crankshafts will be reconditioned to do more work than when new



ETCHING in sulfuric acid bath prepares surface for plating. Anode is enclosed in the flexible filter shown here, then lowered into bath for plating with electrolytic iron. The bond between iron and liner is thus established atomically

Save Diesel Liners...

By plating them with long-lasting porous chromium

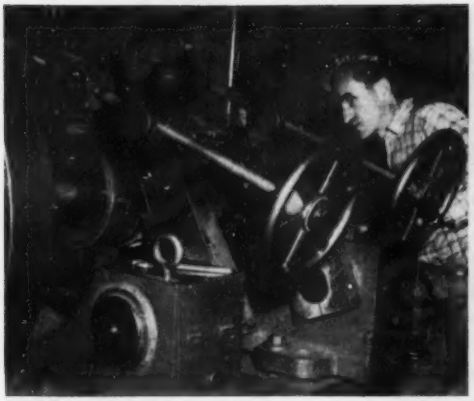
ADVANTAGES

1 Liner wears many times longer
2 Piston rings last 3-5 times
3 Chromium has low coefficient of friction
4 Excellent corrosion resistance
5 Extreme hardness and high melting point
6 Numerous tiny oil reservoirs
7 Good thermal conductivity

► "DON'T SCRAP your worn diesel liners," says Hendrik van der Horst, president of Van Der Horst Corp of America, Olean, N. Y. "Coat them with chromium." And engine owners and manufacturers seem to agree with him. That's why his three plants in Olean are working day and night. We visited these plants to get the story firsthand.

We saw liners of all sizes, for both 2- and 4-cycle engines shipped in for reclaiming—in carload lots. There were also crankshafts and various other critical parts.

With metal shortages and skyrocketing manufacturing costs, liners are too expensive to scrap, especially when chromed liners wear better than new—



FIRST STEP is cleaning cylinder to remove grease, carbon and rust. Then unevenly worn liner is rebored here, to provide surface for restoring to right size with iron plating

BEFORE PLATING with electrolytic iron to restore the worn cylinders to original size, they are dipped in "stop-off" wax. Here, wax is removed from inside surfaces to be plated

BREAKING port edges in 2-cycle cylinders assures smooth travel over them by the piston rings and the piston. Spot checks are made after each of these operations

AFTER HONING to a mirrorlike surface, liner is chromium coated—again honed and rough edges ground smooth as here. Details are important; are checked often

CHECKING chromed and honed cylinder surface for percent porosity with *Inspectroscope* at 50 magnifications. Liners are now ready to do more work than new ones

and cost *less*. Besides, scuffing, seizing and scoring are just about eliminated. That cuts down maintenance.

Chrome applied by this process is dense, hard, wear- and corrosion-resistant. It gives working surfaces an infinite number of tiny reservoirs for retaining lubrication. Invented by Dr van der Horst, it stepped up combat efficiency of military engines for this country during the last war. Since then, it has gained worldwide acceptance as a means of multiplying the service life of cylinders and other bearing surfaces.

But cost factors limited chrome alone to comparatively thin application. Now, an iron-plating process, called Vanderloy M, is overlaid with Porus-Krome, whenever that method is advantageous.

Production Line. After inspection, parts are dipped in alkaline solution for cleaning. Next, small breaks or cracks are welded shut. Then worn bearing surfaces are machined. For example, reboring liners eliminate ring steps, fluted wear and scoring to re-establish concentricity.

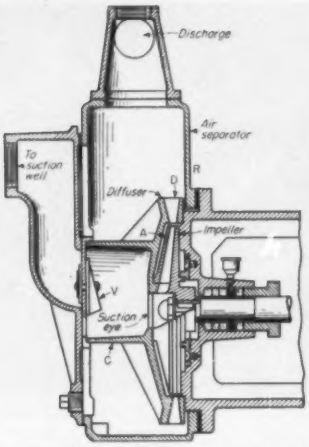
Next, oil soaked into cylinders from use is baked out. Ported cylinders have radius ground at port edges. Ports are waxed to prevent plating. All other parts not to be plated are dipped in molten wax.

Before worn parts are built up with iron plating, they are dipped in sulfuric acid to electro-etch surfaces so plating is atomic bonded. After rinsing, parts are electrolytic-plated. When this iron plating has built up to right thickness, parts are rinsed. Wax masking is removed by hot water. Then edges of plated areas are ground.

Variations in bath composition and plating conditions can produce this iron plating with a tensile strength as high as 100,000 psi, or as low as 50,000 psi.

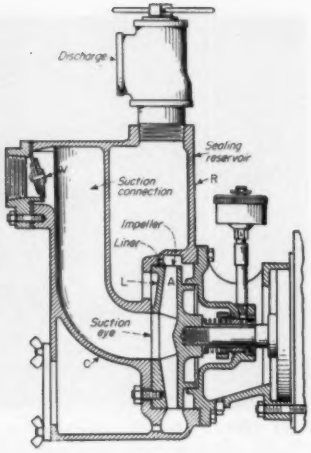
Cylinders are next honed and chrome-plated. Thickness is anywhere from 0.003 to 0.015 in., depending on service needs. Finish honing gives a mirror-like surface.

Numerous routine inspections on every piece of work during processing turn out a highly reliable product.



1 **DIFFUSER PRIMING.** Action of liquid in diffuser and impeller primes pump

2 **LIQUID-AIR** mixture being thrown past the diffuser by the pump in Fig. 1



3 **SINGLE-VOLUTE** centrifugal pump does not circulate liquid when priming

How Self-Priming Pumps Are Primed

Designs of these centrifugal pumps developed so fast, many engineers got lost in the rush. Catch up at one jump. Learn how each works, where it does a good job at low cost today.

By **F A ANNETT**, *Contributing Editor*

► CENTRIFUGAL PUMPS above their suction-well level are not self-priming, so you must have a way to prime them and keep them primed. You can do this several ways. Some auxiliary priming devices are installed outside the pump, while others are built into the unit to make it self-priming. The latter are usually called self-priming pumps.

Self-priming pumps come in several designs. Some have a liquid reservoir only on the discharge. It serves as an air separator and supplies priming liquid. Liquid isn't circulated from discharge to suction during priming.

Other designs have a liquid reservoir on both suction and discharge. Liquid is circulated from discharge to suction during priming. Several designs have automatic valves that stop circulation after pump is primed. Hydraulic action in others stops circulation when the pump primes.

In some designs a small amount of fluid circulates continuously from discharge to suction while the pump runs. Let's take a look at noncirculating designs.

Divided-Tank Priming. A tank separate from the pump is used in different ways to make it self-priming. POWER, Nov 51, pp 120-121. One type has a divided tank built onto the pump. Bottom of lower half connects to pump's suction, and bottom of top half connects to the discharge. Suction line connects to top of bottom half and discharge line to top of upper half.

When bottom half of tank and pump are once filled they remain that way, ready for priming when pump starts. As the pump impeller discharges liquid from bottom to top half, a vacuum is created in lower half of tank and in suction line. Liquid flows into suction tank when vacuum is high enough; pump primes and goes into service. In this design liquid does not circulate from discharge to suction; liquid in tank bottom does priming.

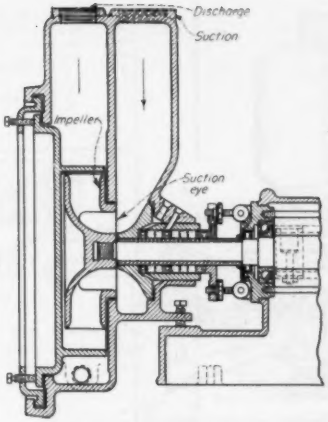
This self-priming type is used mostly in chemical industries, where suction head is usually quite low. Other self-priming designs are primed by a tank or chamber on the discharge only and a closed suction.

Diffuser Priming. Fig. 1 shows a pump primed by the action of liquid between diffuser and impeller vanes. It has a closed impeller, *A*, inside a diffuser, *D*. Suction eye of impeller is in chamber *C*, closed by check valve *V*, to insure that pump, once filled, stays full of liquid. Priming and air-separator reservoir *R* is part of pump casing and encloses suction chamber, impeller, diffuser.

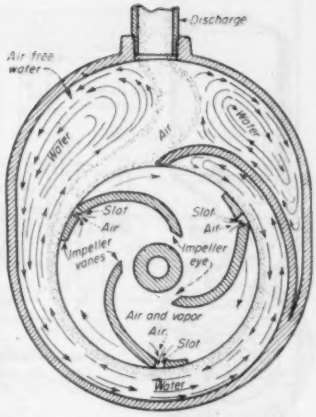
Like other self-priming designs, you must fill pump with liquid before starting the first time. After the first filling pump remains full when stopped, ready for your next start and priming.

How It Works. When you start pump, liquid in suction chamber is discharged into the air separator. We then have a

4 **VOLUTE** *A* is the discharge and *B* the return when this pump is being primed



5 **CORROSIVE-LIQUID** pump has slots in the impeller vanes to prime unit



6 **IMPELLER-VANE** slots act as aspirators to draw air from suction during prime

ring of liquid in the diffuser around the impeller. Air and vapor at ring's center are at reduced pressure, Fig. 2. Since the impeller has only three vanes, *V*, they are spaced widely enough at their discharge ends to let liquid fall between vanes and mix with the air. Then the impeller throws the mixture out through diffuser *D*.

There's violent splashing between impeller vanes when liquid is thrown out. This liquid picks up air, expelling it through the diffuser where it escapes as bubbles to the surface. As time passes, more liquid flows between the impeller vanes to capture more air, purging it to the reservoir.

This cycle repeats until enough air is taken from the suction line to prime pump. Unit then runs as a diffuser type. These pumps can prime on suction lifts up to 25 ft.

Volute Casing. We have a similar priming action in the pump in Fig. 3. But this one discharges into a volute instead of a diffuser. It also has an open impeller *A*, which is closed on the suction side by a renewable liner *L*. Suction connection *C* is closed at the top by check valve *V* to keep pump full of water and ready for priming when stopped.

Sealing reservoir *R* is part of pump casing and encloses suction elbow, volute and impeller. When you start the pump, impeller draws liquid from suction elbow, discharges it through the volute into sealing chamber. This water carries air from the suction pipe and creates a partial vacuum.

Air enters between the vanes and mixes with liquid at the impeller rim. From here the air is discharged to the sealing chamber, where it is released. This goes on until all air is removed from the suction line and pump is primed. It then begins pumping against its working head, as a normal volute type.

Double Volute. Other self-priming pumps have a double volute in an air-separating chamber on the discharge, Fig. 4. Like Fig. 3, suction intake (not shown) is on a level with top of air-separating chamber so pump stays full once it is filled.

In Fig. 4, when pump starts, water in suction chamber connection and between impeller vanes, *V*, is discharged upward into air-separating chamber. This creates a vacuum inside impeller. Air from suction line and water in the pump rush into this void. They mix at the impeller rim and discharge through the right-hand volute *A*, to the chamber, where air escapes.

This causes an unbalance between air-free water in channel *B* and lighter air-laden water in channel *A*. Air-free water flows down through channel *B* into the impeller where it mixes with more air and is discharged up through channel *A*, as shown.

Water circulates until pump is primed. When this happens channel *A* can't take the full discharge of impeller so *B* also becomes a discharge passage, flow being up instead of down.

Impeller Jet Priming. Pump in Fig. 5 handles corrosive liquids and has slots near discharge end of impeller vanes, Fig. 6, to make it self-priming. Impeller eye faces stuffing box so only suction pressure is on packing. Discharge and suction chambers are vertical and the same height so pump, once filled, stays full without a check valve in the suction.

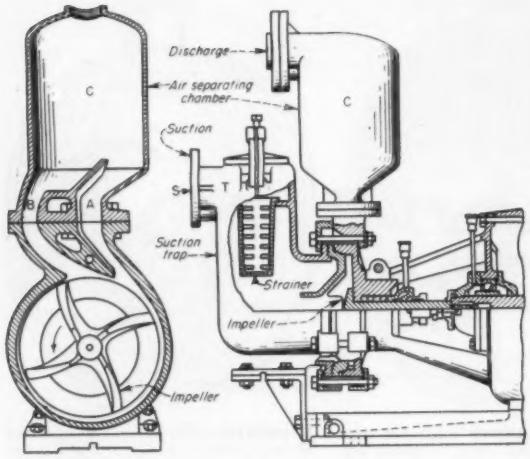
Fig. 6 shows how pump primes. When you start it up, water is thrown from suction chamber into the discharge by the impeller. With a head on the pump, water tends to flow back into impeller. But, it can't get back because the discharge ends of the impeller vanes act like paddles.

Vane ends quickly push water outward, and pressure is reduced on their outside to form an aspirator effect at the slots. Air flows out the slots, mixes with water and goes out the discharge. Air-free water flows back around the outside of the volute to the impeller. This goes on until pump is primed and it runs normally.

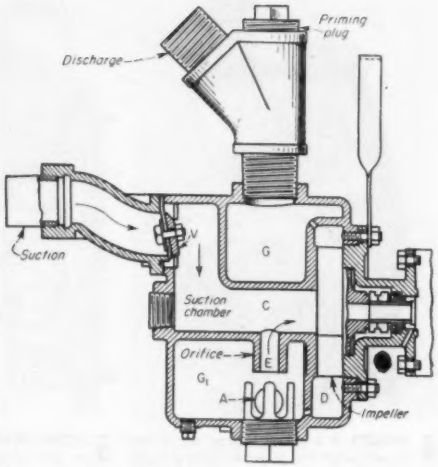
Recirculation Priming. Several types of self-priming pumps recirculate liquid from the discharge to the suction during priming. Fig. 7 shows a unit of this type in which hydraulic action stops recirculation when pump is primed. It has a suction trap, *T*, and an air-separating chamber *C*. Suction pipe connects to top of trap at *S* so once pump is filled with liquid it stays full.

Liquid, left in the pump when it stops, allows it to run as a wet-vacuum pump to prime on your next start. When you start, the impeller turns counterclockwise. It discharges part of the water from the trap and casing into air separator.

There isn't enough water to fill the impeller. What water there is mixes with air and a ring around the casing is formed by centrifugal force. Discharge from the casing goes out throat



7 **HYDRAULIC ACTION** stops liquid recirculation from the discharge to suction of this self-priming centrifugal pump



8 **BALL-CHECK VALVE** stops recirculation of liquid in this pump after the unit is primed. Valve works automatically

A into the air chamber, where the air separates.

Water freed of air returns to the impeller through throat *B*. This water is in a disturbed state, absorbs air from the pump intake and is again discharged to the air separator. Cycle repeats until enough air is taken from suction line so pump can prime.

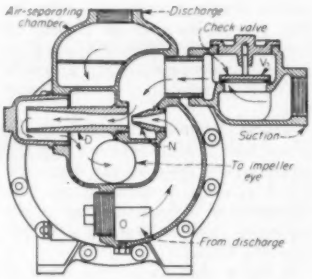
When pump is primed, flow from impeller is so great only part of it can go out throat *A*. Since pressure at throat *B* equals that at *A*, *B* also becomes a discharge, and recirculation from air separator to impeller stops.

Ball Check. Fig. 8 shows a self-priming pump that has a ball valve, *A*, to automatically stop recirculation after pump primes. *G* and G_1 are the top and bottom halves of the pump casing that surrounds suction chamber *C*. An extension of volute *D* connects to *G*. Neoprene suction check valve *V* keeps the pump full of liquid when stopped.

When you start the pump it draws liquid from the suction and discharges into casing *G*. This causes the pressure to drop in *C* and air flows from the suction line through valve *V*. Because of the pressure decrease in *C*, liquid flows in through orifice *E*.

Liquid in *C* is agitated and air combines freely with it to go into the impeller to be discharged to the casing where the air separates. This quickly exhausts air from the suction line until a solid stream of liquid enters the impeller. Pump is now primed and delivers full capacity.

With the increased pressure in casing



9 **JET** and diffuser in the suction of this pump prime it and keep it primed

G_1 and a vacuum in *C*, liquid flows rapidly through orifice *E*. Rush of liquid picks up ball *A*, seats it against the orifice where it remains to stop recirculation as long as pump is primed. If prime is lost, ball drops to start priming again by recirculation. Pump delivers as long as there is liquid in suction well.

Recirculation valves of several types are used on self-priming pumps. One type has a metal diaphragm that springs open and remains open while pump is being primed. This is used instead of a ball valve. Under full discharge head, liquid velocity through recirculation orifice is high enough to close valve and stop recirculation from discharge to suction.

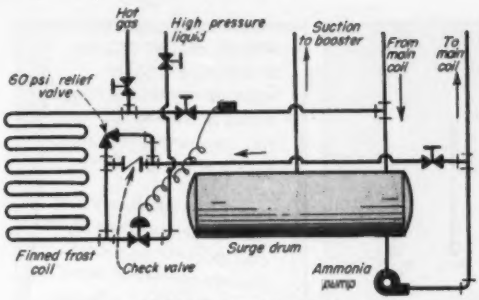
Another type uses two recirculation ports, one on each side of the pump suction. Each is closed by a diaphragm when pump primes. A short section of specially designed rubber tube forms the recirculation port for another type. Under priming pressure the tube stays open and liquid flows from discharge to suction. When pump is primed and there's discharge pressure around the tube, it collapses and stops recirculation.

Still other pumps have circulating valves that are held open by a spring during priming. When pump is primed, discharge pressure closes valve to stop circulation.

Jet Priming. Jets, as in Fig. 9, may make pump self-priming. As in other types the pump is kept full of water by check valve *V* when stopped. An enclosed-type impeller runs in a volute back of nozzle *N* and diffuser *D*. When you start the pump its impeller draws liquid from the suction through the diffuser into the impeller eye and out the discharge.

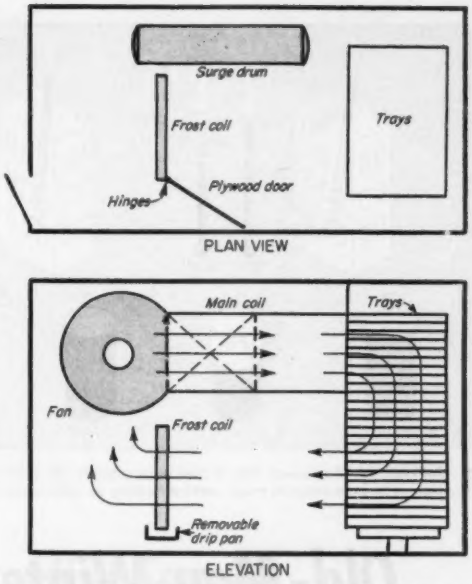
Part of this liquid returns through opening *O*, goes through nozzle into diffuser. This water picks up air between nozzle and diffuser and mixture goes to impeller to be discharged to the air-separating chamber. Here air is released and air-free water returns to the nozzle. This repeats until all air is removed from the suction line and pump primes.

Uses. Self-priming centrifugal pumps come in small sizes for most any job. They are built in close-coupled and flexible-coupled units or for belt drive, and handle both liquid and air. For sumps, nonclogging designs are available. One of the big applications for these pumps is contractor service.



SCHEMATIC PIPING DIAGRAM

HOOKUP for defrosting frost coil with hot gas. Check valve opens at 60 psi, bypassing the condensed liquid to discharge



PLYWOOD DOOR guides cooled air through coil. When the coil freezes up, door bypasses cool air while coil is defrosted

More Freezer Output Now

By **DICK GODFREY**, *Refrigeration Engineer*
John H Dulany & Son

Loose moisture in peas, lima beans, corn and other products caused freezer coils to frost heavily. But moisture-pickup coil and plywood door, to bypass cooled air, solved problem

► IN OUR COLD-STORAGE HOUSE, we have a vertical-column freezer for freezing large quantities of loose product. This usually consists of peas, lima beans, corn and cut round beans. The product is flumed to the loading point. Though everything passes through two dewatering reels, there is still plenty of loose moisture when entering the freezer trays.

Heavy Frost. Trouble is this excess moisture caused the freezer coils to frost very heavily. That reduced refrigeration capacity of the coil. So we were forced to slow down the loading rate shortly after product entered the freezer trays because most moisture was picked up then.

This coil is defrosted with hot gas from the refrigeration compressor at the beginning of each shift, also during each lunch hour. Trouble was that coil often frosted so rapidly we had to hold up processing while we defrosted the coil at unscheduled times. This was costly and besides it upset the plant schedule.

Solution. This season we installed a moisture pickup, or "frost" coil, as shown in sketch. Coil is in center of freezer compartment and picks up moisture from product before cooling coils pick it up. We also added a plywood door for bypassing cooled air.

We start operation with the plywood door in position shown in plan view. That directs air from trays through coil, and from there it goes back to fan intake. Then when frost coil becomes iced enough to retard air circulation, we swing door in front of the coil face. That bypasses air around coil directly to fan. Next, we defrost the coil. This is a simple operation. Suction valve from receiver is closed, and hot gas valve, shown in schematic diagram, is opened. Then compressor discharges hot gas to coils instead of to condenser.

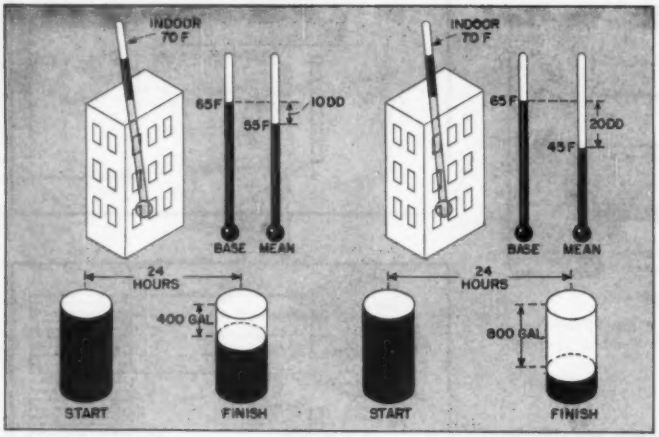
The check valve in line from the liquid ammonia pump closes, and pressure builds up in coil until the 60-psi relief valve, piped around check valve, opens. Then the condensed liquid ammonia is discharged from the coil to the pump discharge line.

When the coil is completely defrosted (takes about five minutes) the hot-gas valve is closed. Then the suction valve is opened, the plywood door swung back into the normal running position and the whole operation repeated.

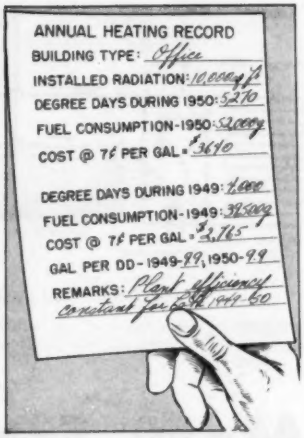
Water draining from the coil during defrosting is caught in a removable pan, shown in sketch. This avoids trouble by preventing drains from freezing.

Another Change. We also piped high-pressure ammonia to the coil. This line has an expansion valve and it holds room temperature over the weekends.

All in all, this defrosting method does make a little more work for the freezer operators, but we knew it would. On the other hand, this extra work is more than compensated for by cutting down capacity-reduction between the usual defrosting periods of main coil.



1 **DEGREE DAYS** are your key to fuel consumption. With 20 degree days per day, *right*, you burn twice as much fuel for heating as with 10 degree days per day, *left*


ANNUAL HEATING RECORD
BUILDING TYPE: Office
INSTALLED RADIATION: 10,000 sq ft
DEGREE DAYS DURING 1950: 5270
FUEL CONSUMPTION-1950: 52,000 g
COST @ 7¢ PER GAL = $3640
DEGREE DAYS DURING 1949: Same
FUEL CONSUMPTION-1949: 39,000 g
COST @ 7¢ PER GAL = $2,765
GAL PER DD-1949-99, 1950-99
REMARKS: Plant efficiency constant for 1949-50

2 **CONVINCE THE BOSS** cold weather means high fuel bill. Use form

Old-Man Winter Jacks Heat Bills?

Cold weather isn't your fault; it never was, never will be. But sooner or later, if you run a heating plant, the boss will have you on the carpet for high fuel bills. Don't let him get the wrong opinion; use degree days to show him what a bad winter will do

By **TYLER HICKS**, *Assistant Editor*

► I'M WRITING THIS on Nov 12, 1951 so can't say if the winter will be a rough one. But be it cold or mild, the fuel you burn in your heating plant this winter may haunt you next. How? Read on.

Suppose this is a mild winter. Your coal, oil or gas bill will be low. If next winter is rough your fuel bill will be high. And you know as well as I do that when the boss sees that high bill he'll give you the nod to come in and explain it. By the "boss" I mean the plant owner, a vice-president, etc.

If this winter is really cold, you're likely to get the nod soon. He'll ask why this winter's bill is higher than last year's. Can you give him the facts? Make a hit by handing out this info:

Degree Days. If you've been around awhile, you've no doubt heard the term "degree day." It's mighty important in all figuring done for heating plants.

Suppose your building needs the usual indoor winter temperature, 68 to 72 F. If you sat down and figured your fuel day by day during the winter, you'd soon see a surprising fact. If on a certain day the *mean temperature* (find this by adding lowest and highest temperatures during 24-hour period and dividing by two) was 55 F and on another day 45 F, you'd burn twice as much fuel on the day with the lower mean temperature, Fig. 1.

Subtract 55 and 45 F from 65 F, and you have 10 and 20 F. Twenty is twice ten, and we burned twice as much fuel on the day when mean temperature was 45 F. Degree days are based on this proven fact.

Definition. With a 68 to 72 F indoor temperature the number of degree days during any day is the difference between 65 F and the daily mean temperature when it is less than 65 F.

Example. Highest temperature in Boston one day last year was 60 F, lowest 34 F. How many degree days were there for that day?

Solution: Daily mean temperature was $(60 + 34) \div 2 = 47$ F. Number of degree days that day $= 65 - 47 = 18$.

Degree-Day Uses. You can figure the number of degree days for any period —a week, month or year—by simply adding the number found for each day in the period. In other words, degree days add up during any period. Better yet, there are tables in handbooks and Weather Bureau data that give average monthly and yearly degree days for every large city in the U.S. and Canada.

Knowing the number of degree days for any period, you can figure how much fuel you'll burn and can compare this season's fuel consumption with last year, or any other year. Or you can compare Jan 1952 with the same month in '51, '50, or go even further back.

In other words, if you run your plant efficiently, and use periods of a month or longer for your figuring, you can explain fairly well the where and why of each unit of fuel burned. It's the best ammunition you can have when you sit down with the big boss to explain high or low heating bills.

Industrial Degree Day. If you have a warehouse or other building where the temperature is kept at, say, 55 F, the usual degree day can't be used. In these buildings the so-called "industrial degree day" is the basis for figuring fuel

3 **DEGREE DAYS** in normal heating season vary as lines show. Best information source is Weather Bureau publications or heating handbooks. Be careful in making guesses from maps as local conditions may throw the estimate way off

Degree Days Crack His Secret

consumption of the heating plant.

Industrial degree day is like the usual degree day except it is figured with 55 or 45 F as the base instead of 65 F.

How Much Fuel? Now let's see how we can find fuel consumption by using degree days. What we'll use is called the *degree-day method*.

Table, below right, gives coal, oil and gas consumption per degree day per sq ft of steam radiation for boiler with 100% efficiency, 10% loss in piping. Indoor design temp is 70 F, outdoor 0 F. For other outdoor temperatures we correct these figures by multiplying by $70 \div (70 - t)$, t being the other outdoor temperature, F.

Example. Degree-day tables show that New York City has about 5270 degree days between Sept 1 and May 31. How much oil will be burned in a building having 10,000 sq ft edr during this period if indoor temperature is kept at 70 F and outdoor design temp is 0 F? Heating plant efficiency is 70%.

Solution: Figures in table are based on 100% efficiency. So we must convert to 70%. Divide unit figure from table by 0.70, or $0.00069 \div 0.70 = 0.000986$. Then oil burned is found by multiplying number of sq ft edr by the unit figure and number of degree days, or $10{,}000 \times 0.000986 \times 5270 = 52{,}000$ gal.

Example: Suppose the above building is only half occupied so only 5000 sq ft edr are used during the period. What is fuel consumption?

Solution: Solve the same as above but use 5000 instead of 10,000 sq ft edr. Consumption is about 26,000 gal. (It would probably run a little higher because there would be heat losses to unheated spaces.)

Example: How much more fuel does a building burn during a heating season of 7000 degree days than during one with 5000 degree days if installed radiation is 12,000 sq ft edr? Coal is burned at an average efficiency of 60%, indoor temperature is 70 F, outdoor 10 F.

Solution. First we correct for efficiency, or $0.008 \div 0.60 = 0.0133$. Then we must correct for outdoor design temperature; $0.0133 \times 70/(70 - 10) = 0.0155$. Coal burned during 7000 degree-day winter is $12{,}000 \times 0.0155 \times 7000 = 1{,}300{,}000$ lb. During 5000 degree-day winter, coal burned is $12{,}000 \times 0.0155 \times 5000 = 930{,}000$ lb. Difference is 370,000 lb.

Present Facts. Our last example is the one you're most likely to use on the boss. To make the best showing possible hit him with all the facts.

Obtain degree days from the Weather Bureau in your locality. Map, Fig. 3, shows degree days in U.S. during a normal heating season. Be sure to get the degree days for the right periods. Then figure your fuel consumption for each. Set it up in tabular form. Underline important facts, Fig. 2, in red, the redder the better.

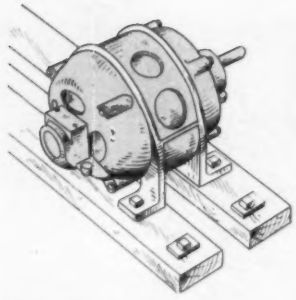
Keep your material on a single page. Make it simple. The boss will appreciate a simple comparison. Efficiencies, stack temperatures and other details may only confuse him. But be sure to include figures that pin down the fact that plant efficiency stayed the same, or increased. Gallons per degree day, Fig. 2, do this nicely.

Be Careful. Degree-day tables are plenty helpful when you know how to use them. If your city or town is listed, just pick out the right value. But if it isn't listed, you will have to find two or more cities near you and work with their values. That's where you may run into trouble.

Suppose you use two cities that are at or near sea level and your plant is in a town on the side of a mountain 2000 ft above sea level. In an exposed location like this the number of degree days may be much greater than for the two cities. The same can be true if your city is near a large lake, a river, or the ocean, and the other cities are inland.

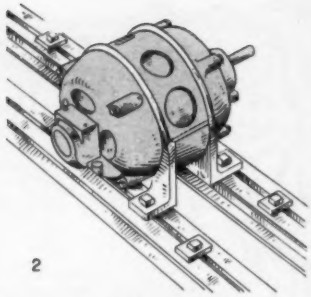
FUEL FOR STEAM HEATING

Based on systems designed for 70 F indoor, 0 F outdoor, 240 Btu per sq ft EDR per hr, 10% piping loss, 100% boiler efficiency:
Coal: 0.008 lb per degree day (HV = 12,000 Btu per lb)
Oil: 0.00069 gal per degree day (HV = 140,000 Btu per gal)
Gas: 0.096 cu ft per degree day (HV = 1000 Btu per cu ft)



Rigid mounts not so hot . . .

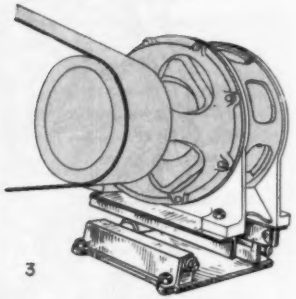
Because the belt slack can be taken up only by splicing, by using an idler, or by uprooting the motor. No thanks!



2

Slide rails stack up better . . .

Because moving the motor increases the belt tension. But you still have to realign the motor under tension. Hmmmmm



3

Automatics fill the bill . . .

Because the belt tension is maintained automatically by weight or by reaction torque of the driving motor. Yessir!

For right belt tension at all times . . .

Make the Motor Base Do the Job

► FLAT-BELT TENSION can be a headache these days. Gone are many of the slow, "long-center" drives where belt sag gave all the tension needed to prevent slippage. Instead, we use individual, high-speed electric motors to drive each machine, and cut the center distance between driver and driven pulleys to a couple of feet. Without the old sag, belt tension must be applied by some external means, the most logical being through the motor base. Let's take a look at the different bases for doing this job.

Rigid Mount. Here the motor bolts to the floor, wall or ceiling with a fixed amount of tension placed on the belt to start with. The only trouble is, if the belt stretches through use or expands from centrifugal force, you have to either take it off and splice it, or uproot the motor, Fig. 1. Idler pulleys are often not practical on short-center drives.

Slide Mount. A second method is to bolt the motor to a couple of slide rails, as shown in Fig. 2. Here again, though, if tension slacks off, you still have to shut down your machine to move the motor back. You also have to realign it manually if there is any sizable play in slots—at best a lot of work.

Probably the best manually adjusted base is a sliding one moved by thumbscrews. The motor is aligned to start with, and tension can be stepped up without shutting down the equipment. This method, however, still requires that someone see or think of the fact that the belt needs tightening, and then perform the operation manually.

Automatic Tension. For every pain, there's a pain killer. Here, it's the automatic-tension-maintaining motor base. This base takes one of three forms employing: (1) gravity (2) reaction torque or (3) springs to give tension under varying loads and varying belt conditions. Here's how each works:

Gravity-Pivoted Base. The motor is bolted to a pair of arms pivoted at one end, Fig. 4. Depending on the amount of tension desired, part of the motor overhangs the pivot center of the base on the opposite side from the driven pulley, and the weight of the motor maintains a constant belt tension.

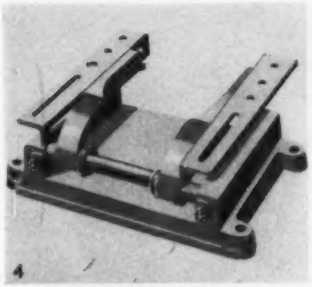
Arms of the base can be adjusted for width and length to take different-size motors, and the motor can be moved to give the desired overhang and tension. For best results when mounted on the floor, the drive should be set up with the tight side of belt nearest the pivot. Whatever the arrangement of drive, the ratio of driven and driver pulleys should go no higher than 7 to 1. It's also a good idea to keep the center of the driven pulley above the center of the motor shaft, and the distance between centers from one to two times the diameter of the larger pulley.

The standard gravity base used on horizontal-drive setups can be mounted on floor, wall and ceiling. For vertical up-drives, the standard base is being used with adjustments in motor position. Vertical down-drive bases have the weight of the motor counterbalanced by heavy coil springs connected by threaded rods to the arms. Tension is altered by adjusting the spring pressure.

Reaction-Torque Base. For every action there's an equal and opposite reaction. That's the principle involved in this design. The motor is slung on a carriage with the pivot between the motor's feet and shaft, Fig. 5.

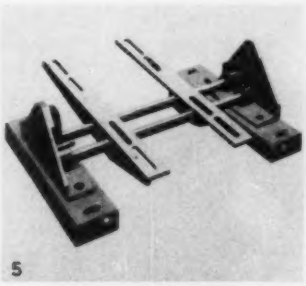
When the stator, by magnetic repulsion, forces the rotor to turn an external load, the rotor forces the stator in the opposite direction with an equal torque. Since the motor is free to swing, this reaction torque pivots the motor away from the driven pulley and tightens the belt. The greater the load, the larger the torque, the tighter the belt.

Since gravity plays very little part in the functioning of this base, the standard form can be used equally well on floor, wall or ceiling mountings. Standard bases of this type, however, must always be used on drives with the tight side of the belt nearest the pivot axis of the base. Specially designed bases can be run with opposite drive.



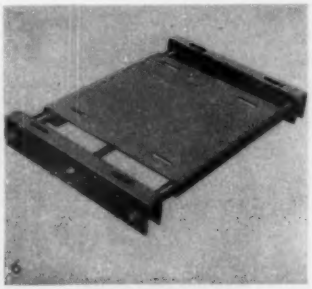
Gravity-pivoted base . . .

Shaft center of motor overhangs pivot center of base on opposite side from the driven pulley. Weight causes tension



Reaction-torque base . . .

Motor is cradled in carriage. Torque of the revolving rotor and load forces stator and frame in opposite directions



Spring-type base . . .

Motor is mounted on a sliding frame, and belt tension maintained by springs. The adjustment is made by thumbscrews

For vertical "down" drives, a special base is used. The motor is counterbalanced by a weight on the opposite side of the pivot, and the drive arranged so the motor will rise away from the driven pulley. For vertical "up" drives, either the standard or the special base may be used depending on conditions.

Some gravity bases have the pivot between the feet of the motor. This utilizes the reaction torque of the motor to vary the tension as the load varies, and the weight of the motor to maintain a constant workable tension.

Mathematical and graphical solutions for motor positioning have been developed for all pivoted bases. Manufacturers provide simplified and accurate data and instructions for installation.

Spring-Type Base. This is not a pivoted base, although it does adjust tension automatically. The motor is mounted on a sliding base, and springs maintain the tension. To increase belt tension, the spring tension can be increased by thumbscrews while the motor is running.

This base can be installed in any position, and will operate both horizontal and vertical drives without modification. At present, this base is available in sizes to fit all standard motors to 15 hp at 1800 rpm. A tight belt means short life for both the belt and the bearings next to the pulleys. Automatic bases maintain tension to fit load requirements, yet eliminate continuous high tensions. Gone, too, is the job of having someone keep track of every belt in the place and how it fits.

—Mech. Power Transmission Council

Are You Up on Belting Q & A?

. . . Find out by checking these practical answers to four questions:

Q: What is relative capacity of rubber, leather belting?

A: When a proper weight of duck is used in rubber belting: (1) four-ply rubber has the same transmission capacity as good-quality single-thickness leather of the same width, (2) six-ply rubber the same capacity as double-thickness leather, (3) eight-ply rubber the same as triple-thickness.

Q. How is machine oil removed from a leather belt without injuring it?

A: Remove all gum or glaze from belt surface by scraping with a putty knife, etc. Spread dry sawdust on belt and sweep off with clean, stiff broom. Then place the belt in a warm place for a few days, packed in clean, fine sawdust, powdered chalk or fuller's earth for absorption of the remaining oil.

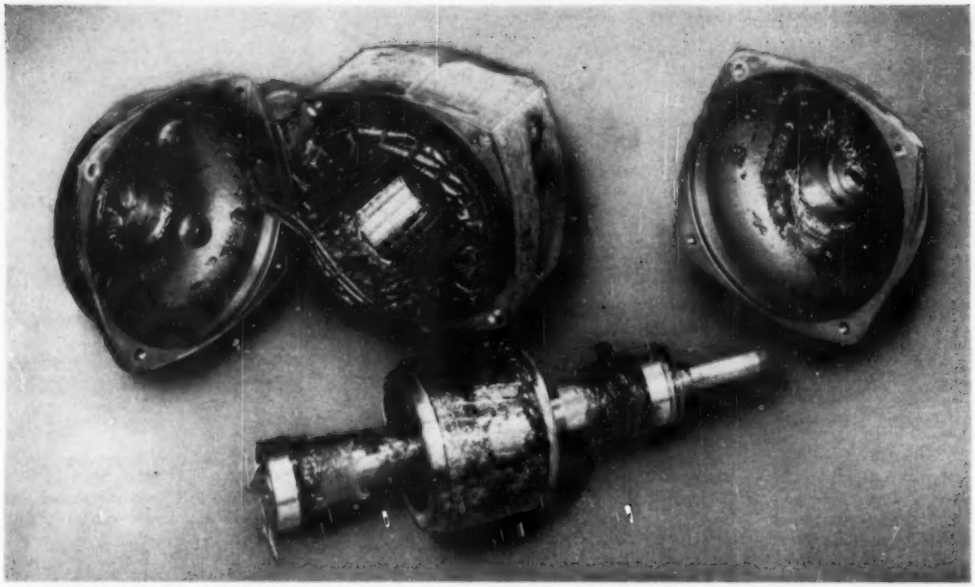
Q: How do you improve flexibility of belting?

A: Remove glaze from both sides of belt with a damp cloth. Give both sides a good coat of lukewarm neat's-foot oil, and rub off dry after standing for 10 to 12 hr. Treat a new belt this way several times a month, and always keep it moderately "stuffed" with oil to prevent stretching and cracking from atmospheric changes.

Q: What factors cause short belt life?

A: Overloading, flesh side of leather belt against pulleys, too much or too little tension, pulleys not aligned, pulleys too small, belt ends not square, excessive moisture, acid fumes, high temperatures, oil, friction between belt edge and guide or other stationary object, using double-ply belts where single-ply should be used, abrasive dirt and dust.

With multiple V-belts, causes are flexing over too-small diameter pulleys, overloading causing slippage or stretch, atmospheric conditions separating belt plies, incorrect service factor (not allowing for starting or shock loads), too few belts, unequally worn grooves in the sheave.



OVERLUBRICATION, a frequent cause of bearing failures, is probably the most needless. Avoid it with proper scheduling.

How Not to Lubricate a Bearing

Bearing failures cripple a motor in short order, yet the cause, more often than not, has been at work a long time

► DID YOU EVER SEE a grease-happy pappy? Well, if you haven't, just take a look at what he leaves behind. That motor's got enough grease in it to lube it 25 years. It's on the shaft, it's on the rotor, it's on the stat coils. Yeah, it's even in the bearings.

Of course, it isn't all the grease wielder's fault. Exhibit A above is the result of putting grease-gun fittings on a small motor and just inviting pappy to let 'er have it. Usually the manufacturer installs cups or plugs on his units to discourage overlubrication. Better still, he puts on sealed bearings, which last a motor's lifetime.

This one's had it. When turned on, it probably just stuck. If it worked at all, it was undoubtedly overloaded. Too, greased winding-insulation rots, losing its resistance and inviting shorts. So go easy on the gun. Remember, more motors are damaged by overlubrication than are hurt by neglect or lack of it.

We've had a lot of questions thrown at us on setting up schedules for greasing bearings (*Operating Engineer*, May 1950, p 62). Some tell us manufacturers recommend adding grease to motor's ball bearings every three months. Others claim they grease once every three years and their bearings stay perfect. When you have any sizable plant operation under your care, this scheduling can be a real problem. It's no great stretch of the imagination to find even a small-plant man responsible for 40 to 50 motors with many running 24 hr a day.

Motor manufacturers have become more and more aware of this plant problem. There's a trend among them to lengthen the span between grease jobs. Part of the reason, of course, is improved greases and bearings.

Some motor-design boys favor the prelubricated, sealed-for-life anti-friction bearings that cannot be lubricated once the motor leaves the manufacturer's plant.

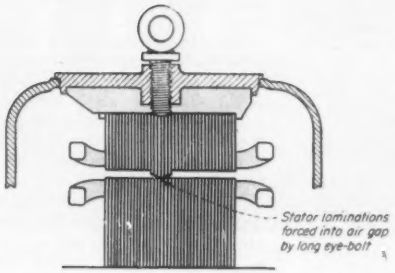
We've had some glowing reports on the prelubes (*OE*, October 1950, pp 38-39). There are cases advanced of cotton mills with 100 motor-groups operating on a 3-shift basis for 7 years and without a bearing failure. That's equivalent to 21 years of service on an 8-hr-a-day basis, 7 days a week. Mind you, this is in a hot, humid atmosphere.

There are others, though, that favor greasing in the field. Maybe not as often as used to be but still at definite periods. They feel that motor service has an awful lot to do with setting up a greasing schedule.

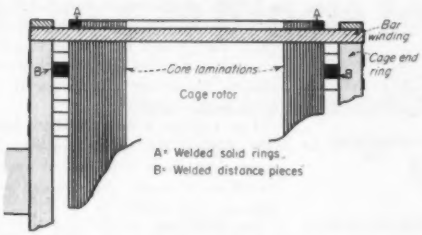
Motors in the smaller frame sizes often operate for the life of the unit without relubrication. Yet where provision is made for regreasing, they can be lubed if need be.

Rotor Fault Oddities

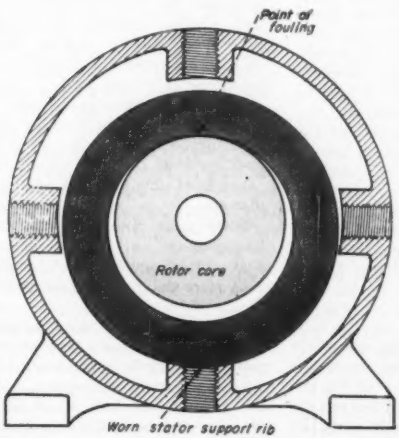
Some new twists to the old jinx with their causes and cures



1 Long eye-bolt forced stator laminations into gap. Illustrative of advantage of "bottomed" holes here



2 Fractured rotor end-plates fixed without rewinding. Three end-plates were welded into heavier end-ring



3 Loose stator wore away supporting rib and dropped on rotor. Frame tapped, stator recentered by plugs

► FOULING BETWEEN rotor and stator cores is usually caused by worn or defective bearings. Occasionally, though, a new cause creeps in. Here are several that might fill that bill, along with their cures:

1. A batch of stator laminations sticking out into the air gap caused the rotor winding of an induction motor to break down. We found a motor eyebolt in contact with the defective laminations, forcing them out of position. The original bolt had apparently been damaged or lost, and the new one made too long in the threaded end. When screwed in, it went too far. This illustrates the advantage of "bottomed" holes in such positions.

2. In several cases axial movement of the rotor-core cage winding caused fracture of rotor-core teeth. Usually the tooth was part of the end core-plate, and did damage to the stator coils where they emerged from the slots. To save stripping and rewinding the rotor for a new and thicker core-plate, the three end core-plates were welded together to form a solid ring. To do this, the plates were turned down almost to the bars forming the cage winding, and a good thickness of ring formed by the weld. The ring was then turned to the diameter of the rotor core.

To stop any axial movement of the cage winding, four copper distance pieces were welded 90 degrees apart, between the core end-plate and the cage-winding end ring.

3. A loose stator core wore away enough of its supporting rib to let it drop onto the rotor. The stator was reset without stripping by drilling and tapping the motor frame at the center points of the four core-supporting ribs. Screwed plugs were fitted into the four ribs and adjusted to secure and align the stator.

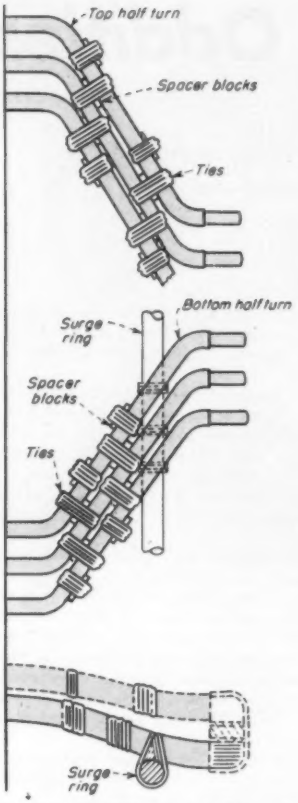
Rotor cores loose enough to cause fouling can generally be detected by rust line at the junction of shaft and core, or core and spider. Welding along the junctions between core and spider arms will often cure the trouble without dismantling the motor.

4. The following breakdown resulted from a change of design during repair that didn't help the repairer's reputation a bit. The stator winding of a 75-hp induction motor developed an earth fault. When the rotor was taken out, we found that some of the stator coils had lifted out of their slots and fouled the rotor.

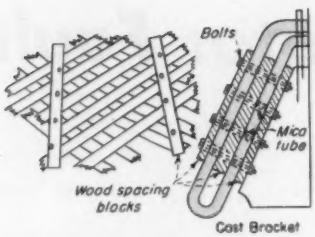
Although the slots were of the open type, provision was made for only very short wedges at each end. The stator coils were concentrically wound with many turns of small-gage wire, and the lack of rigidity allowed them to lift where the slot was unwedged.

It looked like the winding type had been changed, so the manufacturer's specifications were sent for. Sure enough, the stator coils had been heavy copper strips on edge and plenty rigid to need only partial wedging. You can bet your boots we rewound that in a hurry.

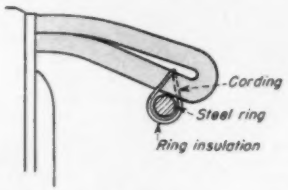
S SPENCE, *Cheshire, England*



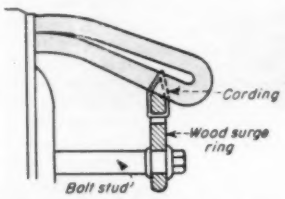
1 **END WINDING** ties of half-turn diamond. Bottom coils lashed to surge ring, all tied adjacently for strength



2 **CAST BRACKET** bolted to frame, coils supported by wooden spacers, mica tubes insulate bolts from the winding



3 **INDUCTION** motor brace. Ring may or may not be braced to motor frame. Two rings, spacer blocks sometimes used



4 **SYSTEM** used for induction motors, ac generators. Laminated wood ring bolted to motor frame, coils tied to it

Bracing Stator End Windings

By C GENTILINI, *Design Engineer, National Electric Coil Co*

► ACROSS-THE-LINE starts, sudden excessive loads, and direct short circuits give motor and generator windings a workout. To prevent insulation breakage and coil distortion, end windings must be securely braced.

Method of tying or bracing depends on the shape of the winding, and on the design of surge rings and supporting brackets. The service duty of the machine determines the design and number of surge rings, and they, in turn, the number of ties per coil. Here are some common schemes for bracing.

Fig. 1 shows the bracing of a half-turn diamond-type coil having only one surge ring for support. The bottom-half coils are lashed to the surge ring. To make adjacent coils rigid, each is tied to the one next to it in two places. As the tying progresses from one coil to another, a network is built that rigidly binds the entire end winding. Spacer blocks of canvas-base bakelite or similar material are used between coils at each tie. Top half is tied the same way, laterally, but not to the surge ring.

Fig. 2 shows the bracing method in older types of turbine-generators. The coil is a semi-involute diamond. Special cast brackets, to which the coils are braced, are bolted to the generator core. Wood blocks space the coils in the end turns, and mica tubes shield the bolts from the coils.

Modern turbine-generators use one or more surge rings. Bottom-half windings are lashed adjacently, and to the ring, all in one tie, while top-half ties are superimposed exactly.

Induction Motor Bracing. Fig. 3 shows the most common method of bracing end windings in induction motors. The surge ring is steel, fully insulated from the coils. Each coil is tied to the ring with a number of turns of cord. Sometimes spacing blocks are taped on coil end-turns in manufacture.

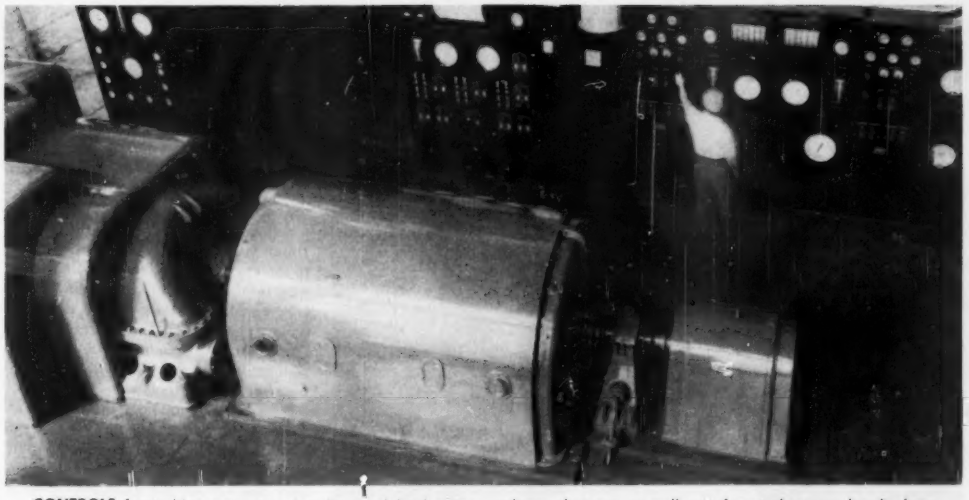
Fig. 4 shows a form for both induction motors and ac generators. The surge ring, made of laminated wood, is bolted to the frame, and the end windings are tied solidly to it.

Tie Materials. Glass cord and flax cord are both used for ties. Glass cord is usually available untreated, treated with a light wax coating, or treated in neoprene. We had best results by vacuum - pressure - impregnating untreated glass cord, with a long-life, flexible, slow-baking varnish, and semi-curing it before use as a tying cord.

Varnish impregnation imparts abrasion resistance to the cord by coating each individual fiber. It also prevents moisture from becoming caught in the network of thousands of small glass filaments.

Some users prefer glass instead of flax cord, not only because it is more heat resistant, but because it is mechanically more stable over longer periods of time.

Flax cord has been the standard material for many years, and usually is entirely satisfactory. It is easy to use, does not require pretreating, is relatively inexpensive. If thoroughly saturated with varnish after installation, it lasts many years. (Abstracted from Jan 1948 issue of *Iron & Steel Engineer.*)



CONTROLS for turbine-generators handle usual load swings, voltage changes, so well you forget they can break down

Who's to Blame for Runaway Turbines?

Pin down your possible failures, human or mechanical. It will pay you to stage a "fire drill" for turbine-room crew

► THE CLAUDE L MATTHEWS Valor Award of the Edison Electric Institute went to John Fallis, a boiler operator, of the Kentucky Utilities Co[1] last June for bringing an overspeed turbine under control at the risk of his life. What did he do?

He heard an unusual roaring noise in the turbine room, found one turbine running at a terrific speed and vibrating heavily. The turbine governor had broken and metal pieces were flying from the machine. Fallis tried the throttle and saw it was jammed open. He raced back to the boiler room, climbed up behind the boilers to shut off steam at the main header. He made it. What makes it even more remarkable was the header was vibrating crazily and seemed ready to break under the strain.

How much of Fallis' action was instinct, instilled by training, or sound thinking, we don't know. But it certainly points up the need for a "fire drill" in the plant, particularly with electrical equipment. It runs so smoothly, responds so well to controls, it becomes second nature to regard it as you would a well-trained household pet.

Hartford Steam Boiler and Inspection Co[2] tells us most overspeed accidents to turbines involve a sudden loss of load followed by a failure of the speed controls and the emergency overspeed controls. In nearly every case, they say, controls fail simply because they've not been tested frequently and "exercised" throughout their full length of travel. This "exercise" is the only way of keeping moving parts free to act quickly and surely. The same reasoning holds for "exercising" the role of each plant operator in an emergency.

Here's an actual case history that shows what can happen. A truck backed into a power-line pole of an industrial distribution system. The power lines swung together when the pole swayed and set up a short circuit. The short brought on a voltage drop throughout the plant electrical system. Two thirds of all the electrical equipment went out when low-voltage relays went into action.

The turbine itself was having its troubles. First, it surged up to meet the short circuit overload. Then, as the short cleared and the low-voltage relays threw off two thirds of the normal load, only one third remained on the machine.

What should have happened was this. The steam valves on the turbine should have opened wide to meet the overload, then closed down to meet the subnormal load. The valves opened wide, all right, but they hung right there and the turbine began to overspeed.

Plant lights went out with the short and then came right back on, very bright. An operator rushed in to shut down the turbine. He tripped the throttle valve by hand, yet the machine kept speeding up and began to vibrate badly. Nothing happened for a few seconds and then the machine slowed down. The vibration had freed the valves.

And the cause? The steam-control valves had become bound at their packings when they opened wide in answer to the short-circuit overload. The throttle valve had also become bound, but fortunately the vibration shook it loose. All in all, a beautiful example of failure from "lack of exercise."

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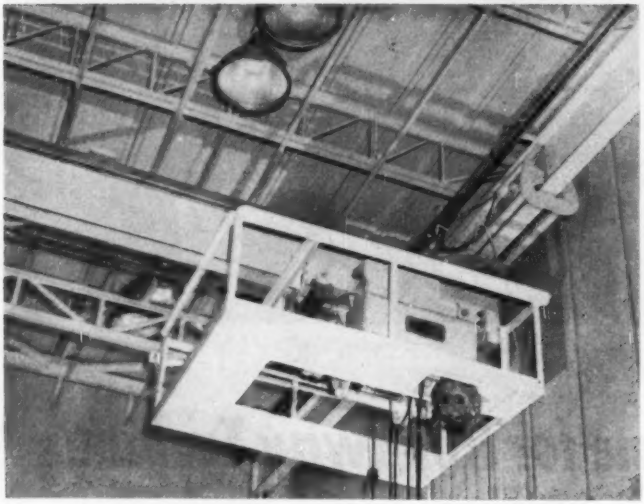
[1] *Electrical World*, p 5, June 12, 1950

[2] *The Locomotive*, Hartford Steam Boiler and Inspection Co, Oct 1950, Hartford, Conn.

PRACTICAL IDEAS... *here's the trading post for your*



CRANE USED FOR LAMP MAINTENANCE

A 60-FT-HIGH CEILING required lamping service, plus maintenance for the floor-controlled crane.

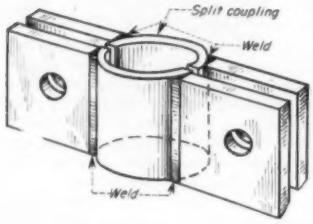
The old technique called for a "safe-way" scaffold. But it was hampered in its movement because machinery in place on the floor made it difficult to erect and remove. As might be expected, the stage was not in place when adjustments or repairs were required on the crane. Besides, it was not economical to raise a scaffold for each 1500-watt lamp replacement in our large plant.

A study indicated that a caged ladder erected in the room's corner and arranged to coincide with the crane's frame would make a good access device to the crane. Hence, erecting the ladder was followed by building a low-railed type of work platform around the crane motor, control panel and drum. Metal "toe-boards" around the base of the railing prevent tools or materials dropping to the floor below.

Now, as a lamp fails the electrician mounts the ladder, enters the crane platform, and is dispatched to any part of the room by an assistant at the pendant controls on the floor. Or, if help is not at hand, he lifts the pendant switches up to the platform level and dispatches the crane to any point he desires to reach by acting as his own operator.

By the same token when crane maintenance of any type is scheduled the ladder-platform combination proves a valuable investment indeed. Here again, one man can adjust the upper-limit switch and all the various control relays by hauling the pendant controls up on the platform and operating the several buttons as need dictates. A disconnect switch, wired ahead of the controls, eliminates any necessity for working in close confinement on energized circuits.

P C ZIEMKE *Oak Ridge, Tenn.*



Split Coupling Makes Vertical Pipe Support

WHEN WE HAVE to support a vertical pipe coming through a floor we make a clamp like that in the drawing. A coupling the same size as the pipe is cut in half lengthwise. We weld two pieces of ¼- or ⅜-in. flat stock to each half and bore two clearance bolt holes through them. When the clamp is bolted to the pipe the threads bite into its surface and prevent slipping. The extensions welded to the coupling span the hole and take the vertical weight of the pipe.

PETER OAKLAND *Alliance, Ohio*

Loose Plunger Causes Pump to Chatter

SOMETIMES THE CAUSE of trouble is a long way from where it seems to be. The high-pressure piston of our triple pumping engine started to chatter, or that is the way it sounded. Increasing the flow of oil to the cylinder gave only temporary relief. We thought the piston was loose on its rod, but had to keep the engine running as long as possible. As a result the engine's cylinder head was not removed.

About a week later, pounding in the water cylinder got so bad we had to shut down the unit. When we took off the cylinder head we found the nut, holding the plunger, loose by two turns. After tightening this nut the pump went into service and did not chatter again.

Apparently the plunger was loose all the time. It is a hollow barrel type and at the end of its stroke hangs more than one half over the end of the liner. Being loose in the liner because of wear, the plunger tended to tip over the end. Then on the return stroke the sharp corner of the plunger would dig into the liner and cause the chattering we believed to be in the steam cylinder.

O C MILES *St. Louis, Mo.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*

Sharp-Cornered Shoulder Causes Shaft to Break

THE SHAFT of a centrifugal brine-circulating pump broke about every six weeks at a shoulder on the shaft where the impeller hub fits. After this happened several times a new chief engineer came on the job. About the first thing brought to his attention was the broken pump shaft. The cause of the trouble was evident—the shoulder on the shaft formed a sharp corner.

The chief ordered a new impeller and had a shaft made with a fillet in the corner of the shoulder. Inside corner of the bore in the impeller was turned to fit this fillet and the impeller assembled on the shaft.

The chief made a name for himself, for almost as soon as the shaft and impeller were ready the old shaft broke. The new unit was installed, and we had no more trouble. Moral: Don't use shafts with sharp corners cut on them. That's only asking for trouble.

R O BILLINGS *Chicago, Ill.*

Ammoniated Water Cleans Oil Burners

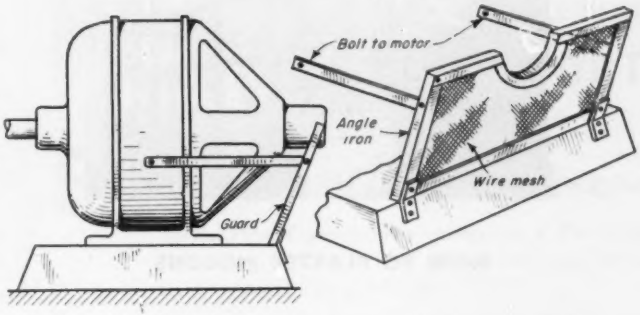
WE HAVE six high-pressure boilers, with a total of 38 wide-range oil burners. We clean each burner once a day.

Here's a time saver for this job: Remove burners from boiler after 24-hr service. Hang burner's tip down to drain into a bucket about 5 min. Put burners into a pail of fairly strong solution of ammoniated water and let soak a few hours. Ammoniated water loosens carbon on burner barrel, cap and tip. Then you can wipe most carbon off with a rag. Wire-brush remaining carbon on burner.

Take burner apart by removing cap, plug and tip. Put them into a pan of stove oil, wash, and blow dry with air. Blow out burner barrel and inside tube with high-pressure air, holding rag over barrel end to catch oil and dirt. Assemble the plug, tip, and tighten the cap. Place burner on rack, clean and ready for use.

We had a lot of trouble scraping carbon off burner barrels and tips before using this method. Besides, we ruined lots of expensive tips. Since using ammoniated water, we have had no burner tip failures in two years.

S R GREEN *Trona, Calif.*



MOTOR GUARD LETS AIR THROUGH

WE HAVE AN OLD open-type motor driving a large circulating-water centrifugal pump. Centerline of this motor is about 5 ft 6 in. above the floor, Fig. 1. The accident inspector rated the lower ventilating openings in the motor a hazard. He said that a man slipping on the floor could put his hand through one of these openings and get hurt.

We did not want to reduce the motor's ventilation by closing the opening so we made a guard, Fig. 2. The frame is made of angle-iron covered with wire mesh. The semi-circular opening clears the bearing to let the guard come up to the motor's centerline.

Two straps bolted to the motor's concrete foundation supports the guard. Near the top of the guard two straps hold it to the motor's frame. Because the pump was used in standby service only, the inspector approved this guard. The openings in the top part of the motor housing considered to be too high to be a hazard.

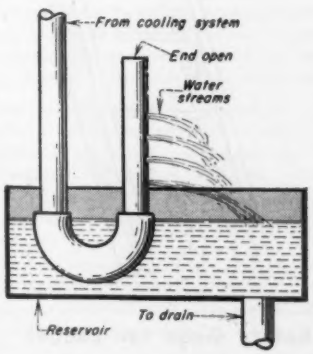
H T LIVINGSTON *Los Angeles, Calif.*

Simple Flowmeter for Cooling Water

OPEN SIGHT DRAINS are used in cooling-water lines from compressors and diesel engines. But aside from the operator's judgment, little can be told about how much water is flowing. To give the operators a rough idea of cooling-water flow I made the device in the drawing.

The cooling-water discharge line ends in a 180-deg turn. A vertical pipe with holes in it threads into the other end of the turn. Spacing and size of holes will have to be found by trial and error. If at maximum required flow the water comes out the top end of the pipe, you need more or larger holes.

After you have found the number and size of holes for full-load operation, find by trial and error, how high the water comes in the pipe for part-load conditions. Knowing these two facts, the supply-line valve can be easily adjusted for the desired quantity.



LAWRENCE ZUERCHER *Dalton, Ohio*

More PRACTICAL IDEAS on page 126

More PRACTICAL IDEAS

Begins on page 124

HOW TO PLASTER PIGEONS

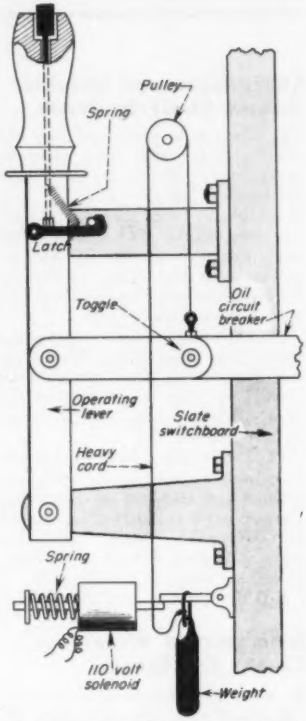
IT COST our utility firm $3050 to sandblast our buildings after the pigeons decorated them. That's when I got a brainstorm. Why not slug the dirty sludgers? Photos show the trap that did the job.

Pigeons like to live in a cote if it has nests, a roost and landing platforms. That's what we built. This trap has hinged flaps we open by rope strung through pulleys from an office window. Soon as the cage is full of flying mud flingers, the porter unties the rope and down go the flaps to trap our visitors.

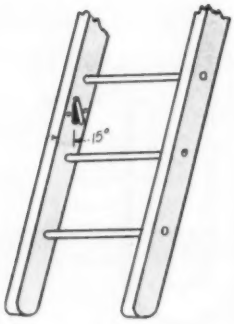
When pigeons calm down at night, the porter enters with a flashlight and picks 'em off the roost. The next step is a pigeon stew, squab on toast, or what have you. And with the high price of meat, this is no laughing matter.

After two years, our window washers can do their job without first having to blast the window sills. From thousands, the bird population is down to about a hundred, and we're all happy. Besides, some of our town folks now look well fed and much less plastered.

D B CLAPP *Pigeonville, Utah*



A RUBE GOLDBERG DOES THE JOB



Safety Gage for Ladder

SAFETY ENGINEERS agree that safe angle for using a straight ladder is 15 deg off vertical. There is *least* tendency to slip or break at 15 deg even under heavy loads. In some shops rule is to set ladder with feet one-quarter of ladder length from supporting wall. Trouble is judgment of distances varies widely with each employe.

To eliminate guesswork, we equip our ladders with a gage to indicate correct angle, regardless of ladder's length. Screw a piece of flat stock loosely on inside of a runner, at a convenient height. Set ladder against wall at 15 deg. Mark outline of flat piece on runner and paint a bright color.

When ladder is set correctly, colored outline is hidden by metal. Place a screw on either side of gage to prevent it extending over edge of runner.

L KASPER *Philadelphia, Pa.*

A Rube Goldberg Clears Power System

ON ONE POWER SYSTEM where I worked we had a hydro plant 6 miles from town and a diesel plant in town. The diesel plant had to run until about 10:30 in the evening but after that, until the next morning, hydro could take the load alone.

A couple of hotel elevators produced load swings on the system at night that spoiled voltage regulation and caused customer complaints. To correct this we pulled the pistons on a spare diesel that had a heavy flywheel and used the generator as a synchronous condenser.

This machine was left on the line all the time. But sometimes during storms at night the hydro plant would be tripped off the system. Since the synchronous condenser did not have a no-voltage release, it remained connected.

The hydro plant could not be started again until the condenser switch was opened. This took time and in a storm the telephone system might be out. Power would be off the system for some time, as no one stayed at the diesel plant at night.

To trip the condenser off the system if voltage failed, we rigged up the device in the drawing. The switch is held closed by a latch and toggle. We

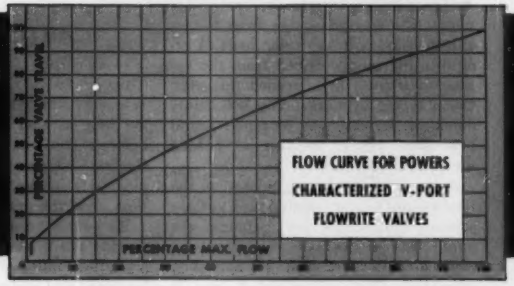
Special Cast Iron Housing and Top Only 4 Bolts
Compressed Air or Water Operated
BALL CHECK LUBRICATOR SILICONE grease for temperatures from 40° to 500° F.
Max. Pressure 250 psi
Max. Temperature 450° F
SIZES: ½" thru 2"
Direct and Reverse Acting

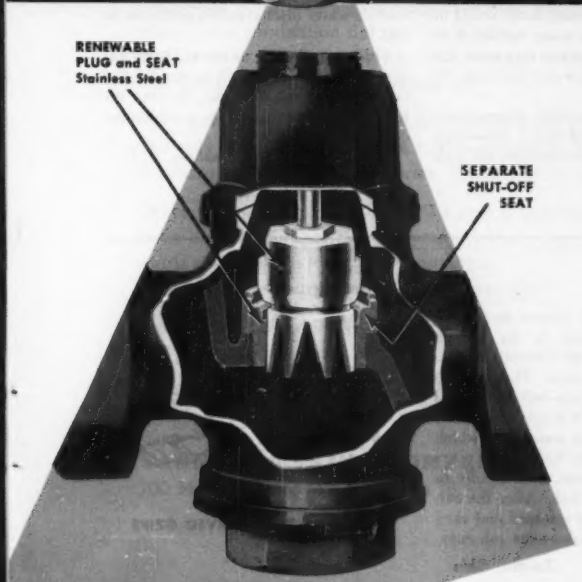
VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment. Maximum air pressure in top, 22 psi.

POWERS® SINGLE SEAT V-PORT *Characterized* FLOWRITE VALVES Give—

Special Flow Characteristics—High lift V-Port plug provides proportional flow throughout entire lift of stem as shown in chart below.

Wide Variety of Valve Sizes—Nine sizes are available, ½" thru 2". The ½" valve can be furnished with plugs to give 15%, 30%, 60% or 100% of maximum capacity. Plugs are easily interchangeable without removing valve from line.





Better Control—Less Maintenance—Superior design of stainless steel plug and seat reduces wire drawing, insures longer life and tight shut off. V-Ports do the throttling, protecting separate shut off seat. Plug and seat are truly removable and can be easily replaced in the field. Inner valves are machined and precision ground and lapped within very close tolerances.

Low Hysteresis—Due to smooth rolling diaphragm and polished stainless steel stem in preformed lubricated packing.

Easy to Adjust—Ball bearing adjusting screw; rust proofed steel calibrated springs with full travel in 5 or 10 psi.

Easy to Install—Powers Flowrite V-Port valves have double unions and bronze body with rugged construction to withstand piping strains.

Easy to Service—Valve and top are easy to take apart and re-assemble, facilitating inspection and maintenance.

Reasonably priced. Contact our nearest office for prices and assistance in selecting proper size valves

THE POWERS REGULATOR CO.

SKOKIE, ILLINOIS • Offices in Over 50 Cities

Chicago 13, Ill., 3819 N. Ashland Ave. • New York 17, N. Y., 231 E. 46th Street
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OVER 60 YEARS OF TEMPERATURE AND HUMIDITY CONTROL

(a70)

Begins on page 124

threaded an eye into the toggle joint and connected it to a heavy cord that runs over a pulley and down to a weight.

Normally the weight hangs on a latch supported at one end by the core of a solenoid as long as its coil is energized. If power fails a spring pulls the solenoid's core back, releases the weight, which falls, and trips the toggle to open the switch. This clears the line, and the hydro plant can be connected immediately.

The condenser can be started again any time the diesel plant is running. This Rube Goldberg hookup did the trick and prevented some long power outages from giving us a headache.

E A Roberts *Carlsbad, N. Y.*

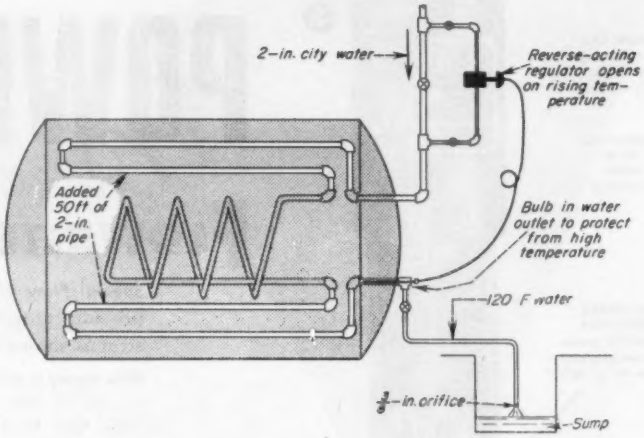
Engine Exhaust Primes Centrifugal Pump

A GASOLINE-ENGINE-DRIVEN centrifugal pump lifts sewage sludge from barges and discharges it on drying beds. A reciprocating pump, driven from the engine shaft by a belt, primed this unit. One day the priming pump was badly damaged. Replacement or repair would have been costly. Besides we needed the pump in a hurry.

A foot valve could not be used on the intake end of the suction hose. After several suggestions for priming the pump, one of the men thought of an exhaust-gas primer that he had seen advertised. One was installed, and it solved our problem.

The centrifugal pump is now readily primed as soon as the engine starts. The new primer has no moving parts, so requires little maintenance.

Fred J Ardolino *Brooklyn, N. Y.*


2-in. city water
Reverse-acting regulator opens on rising temperature
Added 50 ft of 2-in. pipe
Bulb in water outlet to protect from high temperature
120 F water
⅜-in. orifice
Sump

AUTOMATIC REGULATOR SAVES WATER

WHEN WE STARTED our new plant it took too long to cool the boiler blowdown, before it could be dumped to the sewer. Cooling coil was made of 50 ft of 2-in. pipe, to which we added 50 ft of straight pipe as in the drawing.

Blowdown could then be cooled quickly but a lot depended on the fireman. Sometimes cooling water would be forgotten and run to waste for hours, so we installed an automatic regulator that operated the cooling-water valve on rising temperature.

Because the standard thermostatic bulb could not stand boiler blowdown water temperature, we installed the bulb in the cooling-water discharge, as in the drawing.

Even with this control, cooling water leaving the tank was too cold. We corrected this by installing a ⅜-in. orifice on the discharge end of the pipe. The orifice restricts flow to keep the coils filled and the regulator can now hold cooling-water discharge temperatures to 120 F.

This control saves us about 12,000 gal of water per day, enough to pay for the control in about 6 weeks, besides relieving the firemen of a troublesome detail.

Walter J Steinert *Flushing, N. Y.*

Makes Tool to Pull in Superheater Key Caps

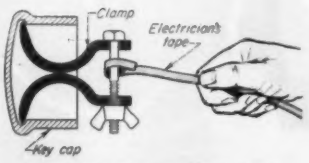
WE HAD TO INSTALL several 2-in. Key caps in a superheater header. These caps had to be taken in from the end of the header and pulled into the holes from the inside

To do this job I made the tool shown in the drawing. It consists of two curved grips, made of 1x¼-in. flat bar, shaped so they can be forced into the groove inside the cap. A stove bolt through the ends of the grips tighten them into the cap's groove and holds them there as shown in my sketch.

To pull the caps in I used an electrician's steel fish tape. The tape is pushed through the cap hole to the end of the header. Here it is attached to the pulling tool and cap assembly, which are then pulled to the hole.

There the tool serves as a handle to pull the cap into the hole After the cap is in place, the tool is released and used for the next cap. Tool makes job easy.

Ernest Berger *Lorain, Ohio*



TOOL HAS TWO CURVED GRIPS

these steam traps won't freeze up!

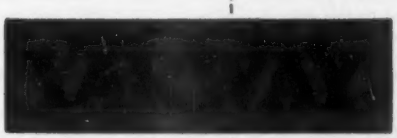
Freeze-ups of outdoor steam traps in winter weather often cause production delays. Don't take that chance . . . especially when it's so easy to install Yarways, the steam traps that *won't freeze up.*

They won't freeze because condensate does not accumulate. The only moving part—a little valve—is continually testing for condensate, discharging it as soon as it forms. There's never anything to freeze.

Other reasons why over 750,000 Yarway Impulse Steam Traps have been sold—they get equipment hotter, sooner; light weight; small size; easy to install and maintain; good for all pressures; made of stainless steel.

More than 200 industrial distributors sell Yarway Traps and Strainers. See your nearest one today. For name, and free 24-page Steam Trap Book, write . . .

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.



the steam trap designed with more production in mind

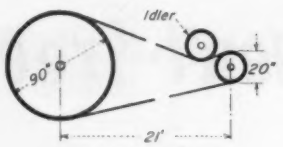
PLANT PROBLEMS ... *put your know-how to work*

HOW CAN WE KEEP LEATHER BELT TIGHT?

HERE ARE THE FACTS: One of our belt drives gives us trouble. It has a 90-in.-dia pulley driving a 20-in.-dia pulley through a 24-in.-wide double-leather belt. Pulleys are on 21-ft centers. To transmit maximum load of about 135 hp, belt must be very tight or it will slip.

When carrying a heavy load the two belt plies always separate. Then we must stop production to repair the belt.

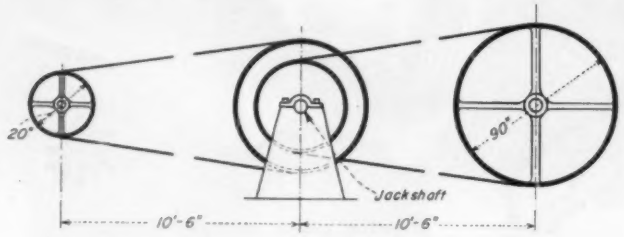
An engineer in a nearby plant suggests running a second belt over the one that splits. Will this work? If so, how wide should outer belt be? How much slack must inner belt have? Or is there a better way of transmitting needed hp?—*JM, Oct Power*



Horizontal Drive

Vertical Drive

HERE ARE THE ANSWERS



SLIP AND CREEP over the 20-in. pulley give *JM* his trouble. They cause heat which loosens cement between belt plies.

Try lining the 20-in. driven pulley with leather from an old belt. This you can easily do if the pulley is plain iron with a smooth surface. Rivet leather to pulley face. Adhesion will be increased.

If lined pulley still won't transmit right power, use the setup in sketch above. It costs a little more, but it solves the problem.

Install a jackshaft midway between the two present pulleys. Fit with two suitable pulleys of the right size to keep rpm in the range allowed.

VINCENT STROJSA *Glace Bay, N.S.*

RIDER BELT wouldn't help *JM*. Plies separate under heavy load. Look for too much heat in belt generated by slipping. Oil in belt, water that drips on belt, water in wheel pit, or steam leakage around belt can cause slip.

Small wrap or arc of contact may also cause slip over small pulley. Buy a new belt, either a leather one with waterproof cement or a composition belt. Keep oil off belt and install an idler to give more wrap around pulley. See sketch above.

ALBERT H MOULTON
Pittsfield, Mass.

OVERLOADED DRIVE, caused by low belt speed, may be *JM*'s trouble. If driver can be speeded up to, say, 120 rpm, driven-pulley diameter increased to 24 in., and a heavy double belt 20 in. wide used, drive will transmit about 200 hp. *JM* will then have a safe overload margin.

If driver can't be speeded up, increase diameter of both pulleys in the same ratio. If driving pulley is made 108 in., driver should be 24 in. Then if a heavy double belt is used, the drive will transmit about 200 hp, also.

Idler to increase wrap around small pulley could be used, but it might be a source of trouble and would shorten belt life.

L M LARSON *Milwaukee, Wis.*

HIGH CROWNS on pulleys, or crowns out of line could cause *JM*'s trouble. Tops of crowns, if both pulleys have them, must be in line. Don't line up this type of pulley by using the pulley edges.

Belt grip on pulley can be increased

ROUGHEN PULLEY surfaces with a portable grinder. This gives better grip. Or cover pulley surface with a lagging of thin pliable leather or canvas. An idler would also increase power transmitted by this drive.

See belt manufacturer for allowable tension in the belt. Examine belt by wrapping a piece of it around a ½-in. pipe and squeezing it gently in a vise. If belt cracks, its quality is poor, or it has been overheated by too much slip.

Neat's-foot and castor oil make good belt dressings. Use only as much as belt will absorb, applying more to outside than pulley side of belt.

ART CANNON
Laurence Harbor, N. J.

SECOND BELT over first will work, but its use isn't recommended. To stop ply separation I suggest that *JM* use celluloid varnish. It has greater water resistance than glue, is extremely flexible, and has a tensile strength almost equal to leather's.

But if *JM* prefers an outer belt, he should use one 10 or 12 in. wide. Slack of inner belt shouldn't be any greater than if the 2-ply belt were being used alone. A good rule is to allow ½-in. slack for every foot between pulley shafts.

JM might go to chain or multiple V-belt drive for this job. These are more efficient.

A J BREUGELMANS *Hoboken, N. J.*

help the other guy cure his headaches

TYLER HICKS, *Assistant Editor*

by lining pulley face with rubber. Use rubber cement to hold rubber on pulley. If rubber is available in band form, put band over pulley and insert a pencil under the band. Apply cement behind pencil, rolling pencil around circumference of pulley until entire band is cemented on.

W E WARNER *Essex, England*

USE NEW DRIVE. Do away with this troublesome drive. Install a 200-hp motor at the point where the 20-in. pulley is now taking its drive. This scheme soon pays for itself by stopping belt renewals and shutdowns. Try it and see.

GEORGE MCNALLY *Kearny, N. J.*

SAME TROUBLE popped up in my plant a number of years ago. We had a 24-in. belt running 24 hr a day. Load was 250 hp, pulley diameters 72 and 18 in. We fitted an idler so it increased arc of contact of belt on small pulley. Slip and belt failure stopped.

I think *JM* could solve his problem the same way. Large difference in pulley diameters and the fact that belt is probably run open are trouble causes.

FRANK A BUTLER *Dalls, Texas*

IDLER and a 20-in. diameter paper pulley would solve *JM*'s problem. Grip of belt is much better on paper pulley than on an iron one.

As cause of trouble, look for a dried-out leather belt, hard, smooth contact surface, small arc of contact, or a shiny pulley. Since driving pulley is over 4 to 1 larger than driven pulley, belt can't be run slack without an idler to adjust belt tension.

Locate idler shaft about 40 in. from center of small pulley shaft. Weight idler to give desired increase in wrap.

ARTHUR BELTON *Montreal, Can.*

WHEN MUST ELEVATOR ROPES BE CHANGED?

HERE ARE THE FACTS: The building I operate has eight passenger elevators and two freight cars. Rope renewal on these elevators is a problem that has always worried me. I'd like help from *Power* readers who have had elevator maintenance experience.

How often should elevator and hoist ropes be inspected? What is a reasonable length of service for these ropes? What's the best way to find when they should be renewed? Are there any rigs that speed the renewal job? We sell old ropes for scrap. Is there any better use for them?—*BF, Oct Power*

HERE ARE THE ANSWERS

RENEW CABLES when a number of breaks have been found. Inspect cables at least once a month. Cables on drum-type machines may not show excessive surface wear, even after a number of years. If you find embrittlement at shackle, cut off embrittled section and reshackle good portion.

Moisture shortens cable life by causing rust, which may break cable. Some state elevator codes require cable replacement after not more than 10 years' service. Also, cables must be reshackled every three years.

When inspecting cables look for (1) rust (2) crown wear (3) number of broken wires in each strand (4) excessive wear at reverse bending (5) condition of cable ends, tension, signs of chafing (6) amount of cable stretch.

Handle cables with care. You can get serious cuts from worn ones.

H A KAISER *Glendale, N. Y.*

PICK A FOOT of the worst part of the rope. Count number of broken wires in each strand. Make a note of breaks.

If several strands show about the same number of breaks and these are well distributed along the measured foot, a total of 20 to 40 breaks per foot may be allowed before replacing rope.

With all breaks in one strand there may be strand distortion. This can cause early failure. Allow only 10 breaks per strand if they are distributed along the measured foot, and four broken wires if breaks are adjacent to each other.

Remember, brakes that stop a car too quickly put a heavy strain on the ropes.

C A WILKES *Oaklyn, N. J.*

EDITOR'S NOTE: *Check with your local elevator inspector before using valves given above. He may have different requirements.*

GROOVE CLEARANCE is important. It should be 1/16 in. for new or remachined grooves for rope sizes of 3/8 to 1¼ in. Machine or renew pulley when clearance gets under 1/32 in.

Lubricate ropes with boiled linseed oil. Use crude petroleum and graphite when there is danger of water contacting the ropes.

Remember that number of stops, car miles traveled, care during installation, size and condition of sheave grooves and right lubrication all affect rope life.

Don't uncoil wire rope like hemp. Run off reel in wheel fashion to prevent kinking and untwisting. Wrap tie wire around rope on both sides of a point to be cut before making the cut. This prevents untwisting.

ART CANNON
Laurence Harbor, N. J.

INDUSTRIAL-PLANT elevator ropes may wear faster than those in other types of buildings. For example, dust from grinders can act as an abrasive on ropes, cutting their life. Sell old ropes for scrap. That's the best use you can put them to these days.

CHARLES H ELBERT *Irvington, N. J.*

More PLANT PROBLEMS on page 132

CORRECTION

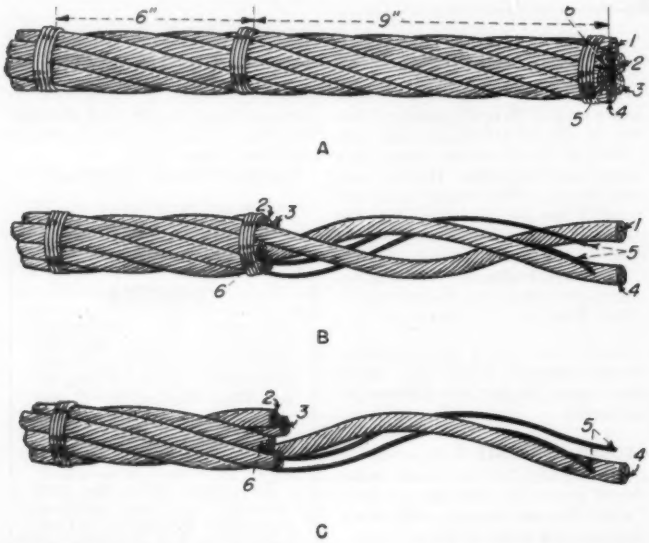
The article "Now Low-Temperature Welding Saves You $$$" (Nov, pp 114, 115) was based on material furnished by Eutectic Welding Alloys Corp, Flushing, N. Y., and referred to products and processes developed by them. Unfortunately, reference to these facts was omitted.

The company states that terms "Eutectic," "Low-Temp" and "Low-Temperature Welding" are its trademarks in the field of welding materials and processes.

More PLANT PROBLEMS

Begins on Page 130

1 **INSPECT** elevator ropes once every three months. This helps you spot troubles before they become serious. If you find breaks in strand wires, inspect oftener



2 **LOOP** for pulling on new rope is made in one end of it. Old rope is attached to loop. Make loops before starting to replace old ropes. This saves time on job

HINTS APLENTY. Here are some suggestions for *BF*.

Inspect elevator ropes once every three months as long as they are in good condition. This is general practice. If you find a suspicious spot in a set of ropes, inspect more often. Do this until the inspector is satisfied the ropes are safe to go three months, or they are renewed.

Reasonable service for elevator ropes before they are renewed is a $64 question. A great many things affect rope life. Some are (1) machine type (2) rope arrangement (3) rope type (4) how they are installed and maintained (5) whether elevators run express or local.

Others are (6) height of car rise (7) control type—manual or pushbutton (8) condition of sheave grooves on traction machine (9) number of reverse bends in rope (10) relation of drum or sheave diameter to rope diameter and (11) judgment of man who inspects and condemns the ropes.

On one group of elevators, in express passenger service with 48-in. drums, some sets of hoist rope ran 150,000 car miles or more. This was during a period of about 20 years. Large drum size makes this installation exceptional.

Hoist ropes running on 36-in. traction sheaves in good condition have given over 100,000 car miles of express service. But some hoist ropes must be renewed after only 5000 car miles or less.

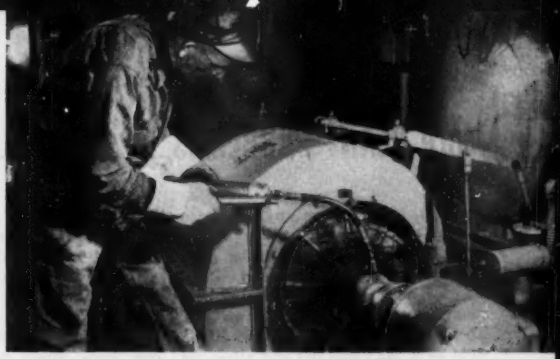
In most buildings you'll find that governor ropes have a shorter life than car hoist ropes. This is because governor sheave is small and rope isn't loaded heavily enough to hold its wires in normal position as the rope bends over the sheaves. Also, if governor sets the safeties on the car, the rope may be damaged by the governor's jaws.

In some buildings the compensating ropes have longer life than hoist ropes; in others, this may be reversed. Rope life on high-rise cars is usually much greater than on low-rise local cars. This comes from less bending around sheaves on high-rise cars than on low-rise ones for the same car mileage. Ropes on a 400-ft-rise car run over the sheaves only half the number of times for the same travel as with a 200-ft-rise car. Bending around sheaves and drums fatigues and breaks wires in the rope, making renewal necessary.

Condemn ropes when six adjoining wires in a strand are broken. This is a general rule. Much depends on the judgment and caution of the inspector. There's no way of exactly judging rope.

See *Operating Engineer*, June 48, p 53,

TO GENERATE STEAM for manufacturing, Triangle Conduit and Cable uses three 350 hp boilers. Each unit generates 22,500 pounds per hour, 24 hours a day, 5 days a week. *Sun Solnus Oil* lubricates the spreader stoker oil bath, *Sun 844 Grease* the pulley drive, stoker motor and pillow block.



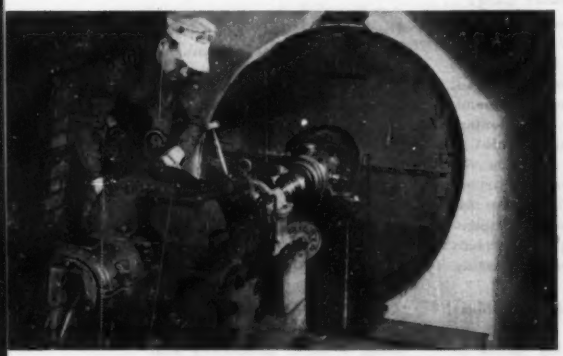
TO CONTROL THE AMOUNT OF AIR entering the fire box, three forced draft fans are kept in constant operation. The motor and fan bearings and the speed reducer motor are lubricated with *Sun 844 Grease*, while the gears and reducers are protected by a *Sun* gear oil.

MODERN POWERHOUSE ENTIRELY SUN-LUBRICATED

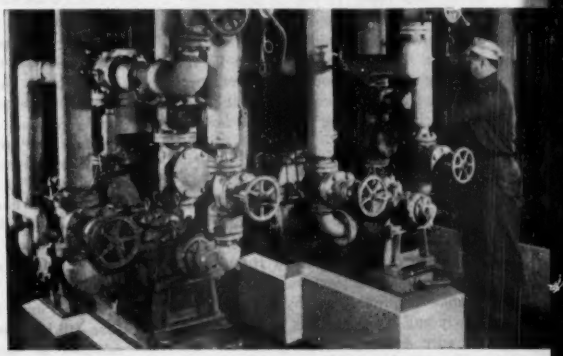
Triangle Conduit and Cable produces flexible and rigid electrical conduit and cable. Its modern powerhouse generates steam for galvanizing pipe and for heating the factory, the pickling vats and the enamel paint vats prior to dipping the pipes. From the very beginning of operations more than two years ago, Sun oils and greases have been used exclusively in all the equipment, and there hasn't been a single failure because of faulty lubrication.

This modern powerhouse is wholly lubricated by Sun "Job Proved" products and the factory partly so. In both, Sun's engineering know-how has effected purchasing and inventory economies through multiple use of a minimum number of oils and greases.

For technical assistance or a copy of the manual "Lubrication of Industrial Machinery," write on your business letterhead to Department **P-1.**



TO HELP GET PROPER COMBUSTION in the boilers, three exhaust fans are used. The turbine which drives them turns up 3,600 rpm. The engineer says the lubricant, *Sunvis 951*, looks like new when it is changed to get rid of condensate.



TO FEED WATER TO THE BOILERS, two 3,500 rpm turbine-driven pumps are employed. A motor-driven pump is used in starting up when there is no steam pressure. *Sunvis 951* lubricates the turbines, *Sun 844 Grease* the pump fittings.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO

Begins on Page 130

and July, p 54, for one way to replace traction elevator ropes.

Cut downtime of elevators by planning rope-renewal job carefully. Make a loop in one end of each new rope. Old rope is attached to loop of new one. Then new rope is run on. Have loop tight so it can't pull out and allow old rope to fall into hoistway and injure someone in pit. Loop must be small enough so rope can run between sheave and rope guard.

Fig. 2 shows how loop is made. Serve rope with a small iron wire about 9 and 15 in. from one end, Fig. 2A. Take off end serving; cut out strands *2*, *3* and *6* at the second serving. Use a pair of bolt cutters for this job.

Leave strands *1* and *4* complete; cut out all wires from *5* except two, Fig. 2B. Remove second serving and cut back strand *1* to last serving, Fig. 2C. Bend strand *4* back into space left by *1* to form a loop just large enough for one rope strand to pass through. Wrap two wires left in strand *5* around the rope end to get a smooth job with only one layer of wire in one place.

After these two wires are wrapped on, take one wire at a time from the bent-back end of *4*, and wrap it around the rope. Do this until wrapping nearly reaches serving. Then cut off remaining wires in strand and cover wrapping and about 6 in. of the ropes with one layer of friction tape. If job is done right, end of rope will be smooth and loop will hold any load put on it.

Make these loops some time before starting to replace ropes. It saves much time and insures good loops on the new ropes. Only a short length is needed to make loop.

F A ANNETT *Flushing, N. Y.*

INSURANCE COMPANIES call for cable inspection once every three months. Six years is considered a good cable life if they have been maintained right.

BF's best test for worn or broken strands can be made by running car slowly and holding a rag around cable. Be sure to inspect all points where cables attach to sockets and where they are clamped.

Judge need of renewal by number of broken wires per strand. Keep dirt and grit away from ropes and pulleys.

Some insurance requirements that may help are: (1) Safety factor should never fall below 4½. (2) Discard standard 6x19 ropes when there are six broken wires in one lay. (3) Replace ropes when outside wires are worn to 2/3 their original diameter.

Make a test run after ropes are renewed. Load elevator with suitable weights. Inspect cables after test and don't carry any passengers until you know the system is entirely safe and meets all insurance requirements.

Old ropes may be used for fences, tow lines, guard rails, cargo slings, cradles for pipe hangers and many other jobs. Be sure rope is safe for the load imposed on it.

GEORGE MCNALLY *Kearny, N. J.*

HERE'S MY IDEA. Inspect elevator ropes once a month. Pay particular attention to car and safety conditions in freight elevators. Replace cables when there are six broken wires in any one rope lay, or when wear on outside wires is greater than 20%. Always call in an elevator inspector when rope condition puzzles you.

Don't fool with elevator safety. It's better to be safe than sorry. If you've ever seen an elevator accident you know this is true.

ALBERT ECKERT *Mt. Vernon, Ill.*

INSPECT WEEKLY. Do this over weekend when you won't be interrupted. Run car slowly and have another man hold a short piece of wood against rope. Hollow out one end of wood to rope radius. Wood helps spot broken wires that may be covered with lubricant.

Danger points are in worn wires, which can be spotted by reduced diameter, rope clamping thimble, and strands with broken wires. Sheaves and pulleys can also give trouble if the grooves are worn or if they pinch the rope. Grooves must be a little wider than rope diameter.

Be sure pulleys are lined up. If they aren't, ropes rub groove sides and wear is increased. Look for worn bushings and sheave pins when pulleys don't line up.

Lubricate rope with a light grade of mineral oil. This seeps into the strands, doing a good job.

Discarded rope may be used as fence wire. But if it can't be used for fences, it should be sold for scrap.

VINCENT STROJSA *Glace Bay, N. S.*

YOUR NEW PROBLEMS

1 What Makes Best Process-Plant Log?

I've just been hired as chief of a new industrial power plant that goes on the line soon. It has a large process-steam load, moderate electric-power demand, refrigeration, air-conditioning, heating and pumping loads.

About 20 men will run the plant and I've been busy trying to work up good log sheets for our turbines, boilers, refrigeration and other units. The right logs cut down errors in running plant.

Have *Power* readers any ideas that will help me? I'd like to see samples of their log sheets to help plan mine. Typical readings entered on sheet would be useful, too.

I'm not looking for a log that exactly fits our plant. What I'm interested in is good ideas that can be used in design of our logs. —*TK*

***Editor's Note:* If you send sample log sheets to help *TK*, why not send us two, one with readings recorded, the other without? Then we can do a nicer layout job. Plant names will not be published.**

2 Will Diesel Cut Creamery Costs?

Our small creamery has a 300-sq-ft hand-fired hrt boiler. Compressors and pumps are motor driven. Maximum electric load at any time is about 15 kw. We buy current from the local power company.

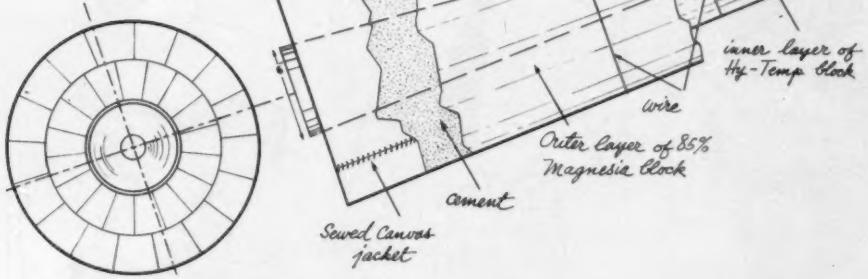
We've been wondering if it would be more economical to install a diesel generating unit to handle our power and light loads. We'd also like to convert the hrt to burn diesel oil instead of coal. Electric bill now runs $200 per month, coal $100.

Is a diesel practical? Would we save enough to make investment worthwhile? Can we burn diesel oil under the hrt?—*GG*

Will you help readers who sent us their problems? Extra pay for photos, sketches.

WE HAVE BEEN ASKED:

"How would you insulate a tapered reducer where regular pipe covering is impractical?"



A power engineer wrote to us recently and outlined this problem: "We plan to insulate a 6" x 2" x 30" tapered reducer which carries steam at 350 lbs. pressure (725° F.) between a pressure reducing valve on a 2" superheated steam line (1000° F.) and a de-superheater. What insulating materials do you recommend and how should they be applied?"

To answer this question, we sent the drawing above and the following recommendation: To minimize heat loss on the 2" superheated steam line, regular pipe coverings of Hy-Temp and 85% Magnesia should be used. These are applied in two 2" layers according to standard specifications for this 1000° F. temperature. On the tapered reducer, the same insulation thickness is used. Here, however, blocks of insulation are applied instead of preformed pipe covering. These must be cut and carefully fitted around the conical shape, then wired securely in place. The layer of Hy-Temp is applied first. This reduces the temperature on its outer surface to a point within the 600° F. temperature limit of the 85% Magnesia, which is then applied to further cut down heat loss. As is the case with the layers of pipe covering, inner and outer joints should be staggered to prevent through joints that result in heat leakage. Joints should be filled in and smoothed with cement. A sewed canvas jacket completes the job.

The next time you have any insulation work to be done, you'll find that Armstrong's thorough knowledge of insulation and its uses can help you. Our Contracting Service can handle the entire job for you—furnish fine-quality materials and the skilled workmen to apply them properly. For further information, just contact your nearest Armstrong office.

SEND US YOUR QUESTION. If you have any questions on insulating materials or their use in high- or low-temperature installations, please write us. We'll see that you get a prompt, practical answer. Address your letter or post card to Armstrong Cork Company, 7001 Maple Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

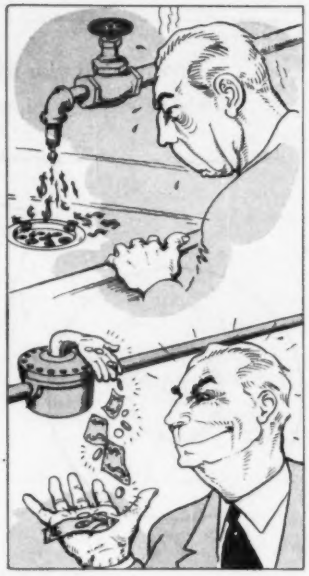
MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

TYLER HICKS, *Assistant Editor*



Wants More Info For Older Plants

S B ROBERTS wrote a fine article on bark burning (p 92, Sept POWER) in new furnaces and boilers. Now all the fireman needs is a new white suit. Almost anyone can burn bark in a new boiler. But how about the boys with boilers that are anywhere from 10 to 20 years old? They're the ones who need help. Someone should get on the ball.

I think O F Campbell was a little off base when he said (p 109, Sept POWER) that oil pump will pick up oil from tank. Pump can't pull oil from tank if distance between them is great. He should install an oil-transfer pump at tank. This discharges oil to a service tank just outside boiler room. Have tank high enough so there's some gravity flow.

For sure-fire results use a steam and a motor-driven pump to supply oil to preheaters and burners. Run all recirculating and drain lines to service tank. This saves pipe. Remember, pipe costs money these days.

B D RILEY *Brunswick, Ga.*

Where Were the Internal Vibrators?

ANSWERS TO March Plant Problems (pp 138-139, June POWER) showed good uses of vibrators, but they were all fitted to outside of bunker. In one plant I know of internal vibrators are being used. They do a fine job.

This plant burns ¾ to 1½ in. rough slacks with up to 35% fines. Electromagnetic vibrator has four crossarms at its lower end and is suspended from top of bunker. Vibrator is about 3 ft above bunker outlet.

A length of 2-in. heavy-gage pipe supports the totally enclosed vibrator from the gantry across bunker top. Coil spring at upper end of pipe rests on gantry, transmits vibrator weight to it. This stops vibrations that would reach gantry.

Electric supply is run inside pipe to vibrator coils. Control switch is on the firing floor, convenient to the boiler operator. When a coal jam occurs, the operator switches on the vibrator for 30 to 60 sec, or until coal flows freely.

R DAVIS *Northampton, England*

Better Soot-Blower Drain

ARTHUR BELTON'S WAY of draining soot blowers (p 128, Sept POWER) wastes plenty of steam. We used the same trick in England years ago, but once we found how much steam was wasted, we switched to steam traps. They drain lines automatically and need little attention or maintenance.

CHARLES A SPENCE
London, England

Trapped Engineer

THE MEN in our plant don't often get peeved over an argument. But the one we have going on now is a lulu that nettled several of the boys. This is it:

I don't trap superheated-steam lines: instead I use orifices. The gang says superheated-steam lines should be trapped to remove condensate formed during line warm-up.

The way I see it, an orifice will do a good job. But I've got to get this settled. Let me hear from any men who have settled this argument. I need help!

TOM L DEAN *Los Angeles, Calif.*

Send your opinions on Dean's argument to POWER. *We'll see that he gets them after they are published.*—ED.

● **LOAD ON BOILER CUT BY 75 HP** by trapping with Armstrongs, says Chief Engineer of large midwestern hospital.

● **30°-40° TEMPERATURE INCREASE** on 8-roll ironer after unit trapping with Armstrongs, reports large eastern laundry.

● **STARCH DRYER HEAT-UP TIME CUT 2-3 HOURS** after retrapping with Armstrongs, says Canadian plant engineer.

● **125 HP BOILER NOT NEEDED** — 80 HP boiler does the job since Armstrong traps were installed in a chemical plant in Iowa.

● **50% SAVINGS IN TRAP MAINTENANCE LABOR COSTS** since installing Armstrongs at midwest agriculture machinery plant.

● **COOKING KETTLE OUTPUT SPEEDED UP 30%** by Armstrong unit trapping at large canning plant.

... BIG EFFECTS from little traps! The "shadow" cast by a steam trap is multiplied in size by the number of traps in your plant until it grows to be a giant that you can't shrug off. Let your nearby Armstrong Representative show you how Armstrong Trapping can cut *your* fuel, production and maintenance costs. Call him today.

Write for STEAM TRAP BOOK —
36 pages of useful, how-to-do-it data. Free on request.

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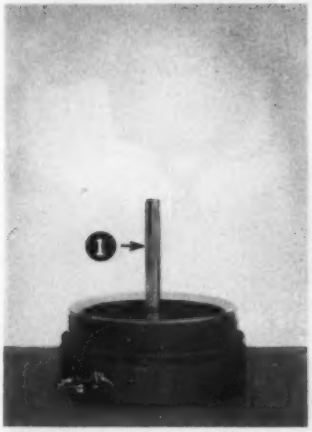
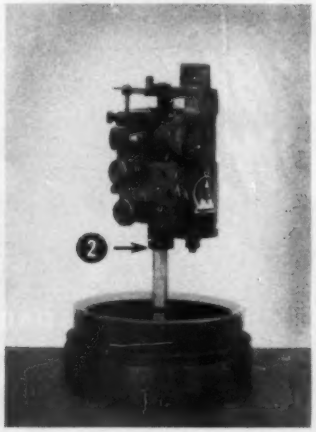
ARMSTRONG STEAM TRAPS

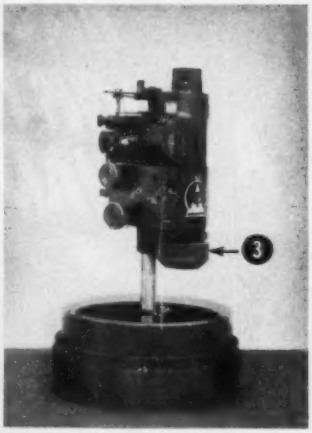
HOW TO GRIND DIESEL VALVE SEATS



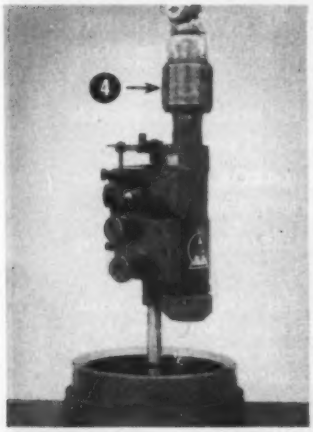
INSTALL PILOT BAR in valve guide for the first step in setting up this grinder



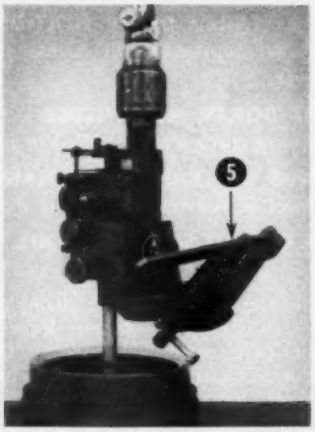
PLACE THE GRINDER on the pilot bar. This is a compact unit, easy to handle



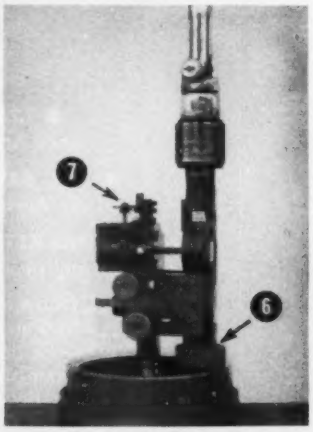
SCREW ON GRINDING WHEEL. Make sure it is the right-sized wheel for job



MOUNT AIR MOTOR on grinder. Motor weighs only 3½ lb, uses 90 to 125 psi



MOUNT WHEEL DRESSER on the grinder. Dress wheel to proper angle with diamond



ADJUST GRINDER to just clear seat face. Start grinder — feed slowly by ratchet

New Portable Valve-Seat Grinder Does Job Quickly

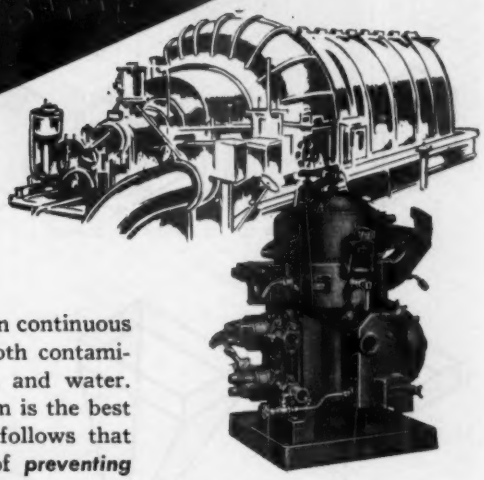
► LARGE INTERNAL-COMBUSTION-ENGINE valve seats can be ground with this valve grinder. It grinds inside seat and counterbore diameters from 2 15/16 to 12 in.

Grind valves on the engine or on work bench, wherever air is handy. Unit is driven at 10 rpm, around a pilot centered in the valve guide. Grinding wheel makes 12,000 rpm. Dress wheel with attached wheel dresser after grinder is in place. Wheel provides angle from 0 to 90 deg. Use from 90 to 125 psi air to run air motor. Air operation cuts down fire hazard if gasoline fumes are present. After grinder is set up and wheel dressed, feed into work with ratchet feed lever.

Courtesy Thompson Products, Inc, Bell, Calif.

A DE LAVAL OIL PURIFIER

TURBINES



A De Laval Centrifugal Oil Purifier, on continuous by-pass, keeps the turbine oil free of both contaminants that tend to cause trouble—dirt and water. Since a perfectly clean lubrication system is the best protection that a turbine can have, it follows that a De Laval Oil Purifier is a means of ***preventing*** turbine trouble.

De Laval machines, by means of centrifugal force applied most advantageously in the large-diameter bowl that characterizes De Laval construction, remove all solid and liquid contaminants. The solids are stored in the bowl where they cannot recontaminate the oil; the water is discharged continuously.

If a water leak should ever occur, a De Laval unit will prevent serious damage, for all De Laval Oil Purifiers properly selected for size in the first place have ample reserve capacity to keep the oil dry until repairs can be made.

THE DE LAVAL SEPARATOR COMPANY
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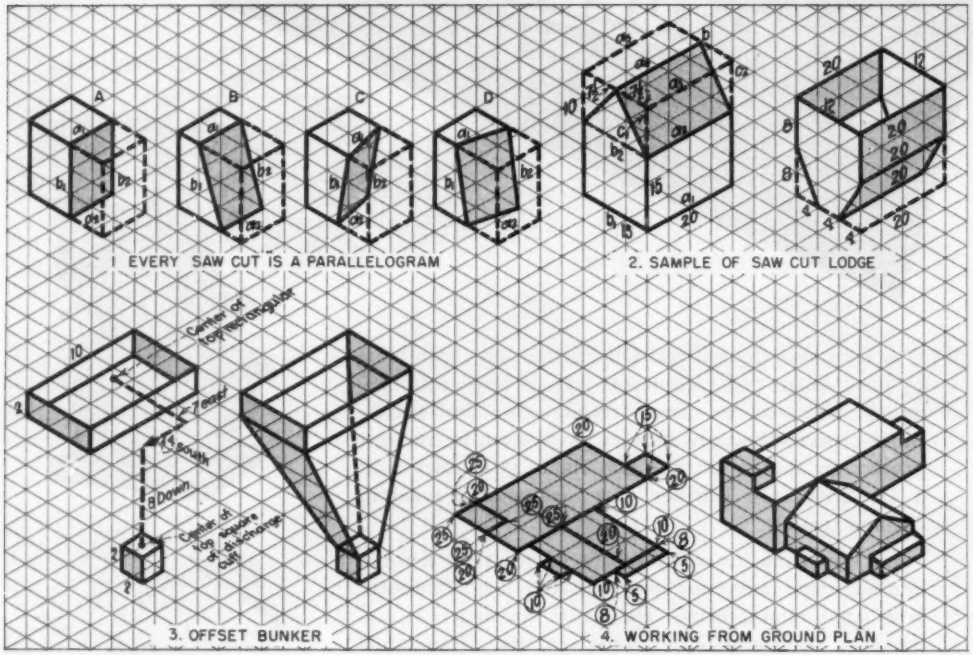
DE LAVAL

LUBRICATING OIL PURIFIERS

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Isometric Sketching-4

► IF YOU LEARN how to sketch a square timber sawed at any angle, you can apply this skill to many other objects.

A, *B*, *C* and *D*, Fig. 1, show four cases. In *A* the saw cut (shaded) is square with the timber. The cut surface is really a rectangle, but the tilt of the isometric makes it appear as a parallelogram—a 4-sided figure whose opposite sides are equal and parallel. *Note that any saw cut of the timber will appear as a parallelogram—even if the saw tilts.* In all four sketches, $a1 = a2$, and $b1 = b2$.

B shows a cut that's square with the side, but tilted to the top. To complete this sketch all you have to know is one side *b*1 or *b*2.

Sketches *C* and *D* show saw cuts that are tilted at both top and front of the timber. In any such case you can always finish the sketch if you know how the cut lines run on any two sides of the timber. In fact, it's enough to know the cut line on one side, plus one point of cut on any other side. Test it yourself.

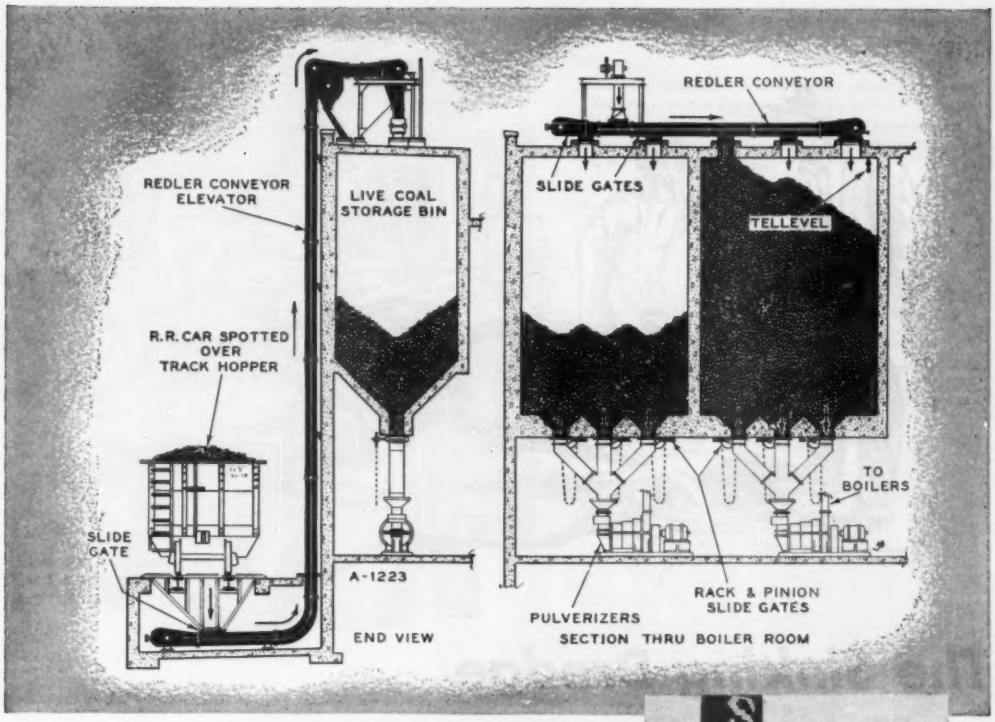
Now if you imagine the two objects in Fig. 2 as small block models, you see that they could be produced by simple saw cuts. The cut surfaces will always appear as parallelograms.

To draw the house model, first lightly sketch a block 15x20x25 in. Locate the eaves 15 ft up from the bottom edges. Ridge pole *a*4 runs straight down the middle of the top of the block. To finish the gables connect ends of the ridge pole to ends of the eaves. Note that side of roof appears as a parallelogram ($a2 = a4$, and $c1 = c2$). The same idea holds for the bottom of the bunker.

Sketching bunkers is easy even where the discharge end is offset. In Fig. 3, top center of the discharge cuff is 7 ft east, 4 south, and 8 down from the center of the top rectangle (follow dotted lines). Then complete the top and bottom cuffs by methods already explained. Connect cuff corners to get edge lines. Erase hidden lines.

What looks like a tough isometric sketch often turns out to be easy. Say you want to sketch a very irregular building on your factory plot. First draw the plan of the building in isometric (Fig. 4, left). At each corner and intersection on this plan write a number showing elevation of top of building at that point. Next step is to draw a vertical line of that height from each point in the plan. Connecting the top of these lines gives you the shape of the whole building.

Erase hidden lines. That's how the left sketch in Fig. 4 is converted into the picture at the right.

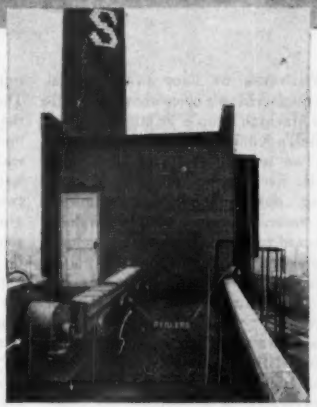


TRIPLE-ACTION Coal Handling

That's Dust Tight!

From cars to bunkers, power plant coal is moved speedily and efficiently *at lowest ton cost* by a compact, space-saving REDLER Conveyor-Elevator—a three-in-one unit that feeds, conveys and elevates. The sealed, dust-tight, weatherproof REDLER casing prevents spillage or escape of coal dust.

S-A engineers drew on more than a half century experience in all types of material handling problems when they designed this installation. You will save time and money—without obligating yourself—by talking over your material handling problems with S-A. Write us.



HARRIS-SEYBOLD COMPANY
Cleveland, Ohio

Coal from track hopper is elevated 50 feet in REDLER casing up the side of boiler house. It is then transferred to the feed section of a 28-foot horizontal REDLER Conveyor above storage bunkers. Five discharge gate-fitted outlets then chute coal through roof into a double-compartment storage bunker. Coal is reclaimed by gravity flow through gate-controlled multiple chutes to pulverizers which prepare it for the boilers. An S-A TELLEVEL storage control unit shuts off the REDLER when bunker is full.

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50 years experience with bulk handling
STEPHEN S-A ADAMSON MFG. CO.
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DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

"I see you've still got this dredge afloat," I greeted him

The Sinking Dredge

► WHENEVER WE DROP INTO Marmaduke Surfaceblow's office above O'Houlihan's Machine Shop & Engine Works in the Hell's Kitchen section of New York City, we usually run into interesting people. Ever since he hung out his consulting engineer's shingle, admirers have started beating a path to his door. We heard rumors that some of his closer friends and shipmates haven't gotten closer than the Bent Propeller Bar, but they at least were *headed* in the right direction.

Today we met Dick Larkin, a fellow McGraw-Hill editor from our Pittsburgh office. Dick flew in and wanted a few things cleared up on dredges. As usual, Marmy had plenty to say—but not exactly what Dick was looking for.

"Back in 1934," started off Marmaduke, "I got tired of being on the beach in New York, and headed for the Middle West. I read in POWER magazine that a large hydroelectric power plant was being built at Fort Peck, Montana, on the Missouri River.

"Shortly after landing there, I ran into Pete Starrett, an old shipmate. Pete and I had engineered on Mississippi boats years before.

" 'You're just the man I'm looking for,' said Pete, slapping me on the back. 'I'm in charge of the dredging operations here. I've got four new dredges. They were just built, and we're ironing the bugs out of them before our fall operations get into high gear. By fall, each dredge will have a lever man, two maintenance mechanics, two electricians, two diesel mechanics and a dredge engineer. My old engineer is retiring soon and the only other help I got so far can't tell a throttle from a plow handle. With your experience around all kinds of plants ashore and afloat, you should have those dredges running like sewing machines before long.'

" 'Sounds good to me,' I said. 'This job's a little different and right up my alley. I'll take it.'

"Next morning, when I showed up, Pete took me aboard the *Jefferson*. She was a big dredge of 650 tons displacement. Her four 750-hp diesel engines and large 28-in. centrifugal pumps made me feel right at home. She had a 5-ft diameter, basket-type cutting head for digging soft material while rotating at about 26 rpm.

"Auxiliary equipment included service-water pumps, and 5-drum winch for swinging and hoisting the cutter's ladder. Besides, the *Jefferson* had two steel spuds about 35 ft long. And those spuds are the meat of this story," roared Marmaduke, plopping his size-16 shoes up on his rolltop desk and puffing away.

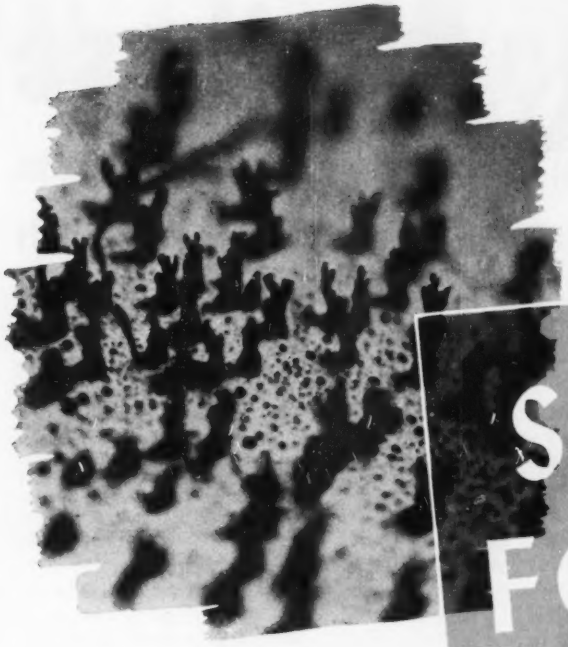
"In case you landlubbers don't know it," he bellowed, "spuds are used to anchor the dredge and to 'walk' her from one position to another. Those spuds were long, hollow steel shafts, 14-in. in diameter, and each weighed about 20 tons. They were pointed at the bottom end and each lowered into the river bottom through a spud well on both sides of the stern end.

"To work itself ahead, the *Jefferson* also depended on its port and starboard bow anchors, that were spaced about 250 ft apart. Also on those two rear, bottom-pointed spuds. We used first one of those spuds and then the other, with each swing from port to starboard, to walk the dredge ahead for each new swath.

"The old engineer started up the plant. Then I traced out the various systems so I understood the job with my eyes shut, as I always do in any plant I operate. Before long I felt at home again.

"Pete came aboard that afternoon and said he was anxious that nothing happen to the dredges at night. Said he'd have a watchman aboard at five o'clock to relieve me. The watchman was to keep his eye on all four dredges. But

(*Continued on page* 210)



Photomicrograph of one type of silica scale in early formation stage. Further deposits will fill in between the "trees" to form a dense, glass-hard, insulating covering that is extremely difficult to remove—and impervious to usual water treatment techniques.

STONE FOREST

(The boiler scale that fought back)

● When silica scale was mentioned, water-treatment experts used to change the subject quickly . . . until a plant using The Nalco System began having scaling troubles due to high silica content of the raw water.

That was many years ago. Today, the same plant, operating at 135 psi, maintains 500 ppm (29.4 grains per gallon) silica in boiler water without scaling.

The Nalco research program that solved this low-pressure boiler water silica problem is a continuous one, so that today The Nalco System successfully meets the challenge of silica wherever it arises in the field of water conditioning.

Whether your water treatment problem is silica—or something even tougher—Nalco has the solution, or can put the full facilities of the Nalco Laboratories to work on it for you.

LATEST STUDY ON SILICA CARRY-OVER

At operating pressures over 400 psi another silica problem—that of silica carry-over—often arises. One of the 1951 ASME papers, "Correlation of Silica Carry-over and Solubility Studies" is an up-to-the-minute, informative discussion of this problem. You are welcome to a copy. Just write to National Aluminate Corporation.

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco*®

SYSTEM . . . Serving Industry through Practical Applied Science

All these

Valve combinations assembled with

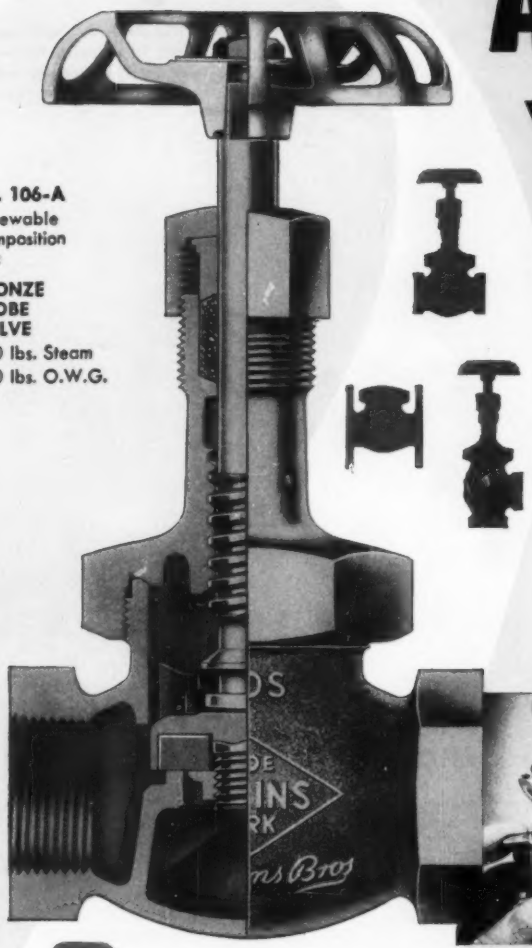
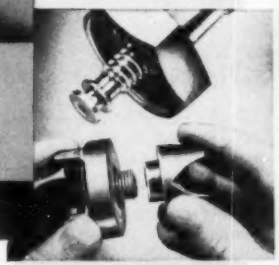


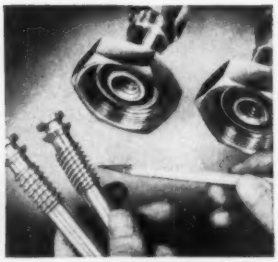
Fig. 106-A
Renewable Composition Disc

BRONZE GLOBE VALVE
150 lbs. Steam
300 lbs. O.W.G.

Starting with the standard Fig. 106-A Renewable Composition Disc Bronze Globe, a wide variety of valves can be made up by interchanging 4 bodies and a handful of parts. Trimming fits Globe or Angle body, screwed or flanged.



FOR CLOSE CONTROL — In throttling service, the nut which holds the disc in the disc holder is removed and replaced with Throttling Nut, Fig. 344.



FOR QUICK OPENING AND CLOSING — Merely substitute the bonnet and spindle from Fig. 941, in which threads are pitched more sharply.

INDUSTRY'S ALL-TIME FAVORITE, TOO, FOR LONG RANGE ECONOMY

It's easy to see why Fig. 106-A sets records for endurance. Liberal dimensions of body and bonnet permit repeated disassembly and reassembly without distortion. On the heavy, manganese bronze spindle, there are more threads in contact with the body, whether valve is open or closed. The disc holder fully protects the edge of the disc, prevents creeping, flaking, or cracking. Every part, from handwheel to pipe end hex, is a feature that contributes to record-setting performance.

Valves from ONE!

for 90% of industrial piping

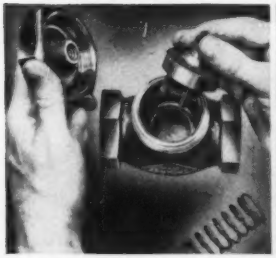
4 bodies and a handful of parts

JENKINS FIG. 106-A "FAMILY"

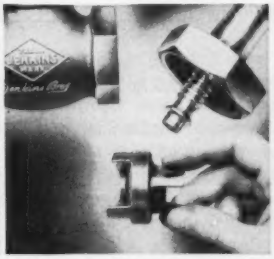
Look over these pictures and see how easy it is to make up just the valve type you need, simply by interchanging parts. Think of the saving this means in maintenance expense . . . in reduced inventory of spare valves in your stockroom.

That's a big reason why the Fig. 106-A series takes top honors in any poll for valve preference. And, time-proved design makes them the longest-lasting, lowest-upkeep valves money can buy.

Remember, Jenkins Bros. is the originator of the renewable composition disc valve,—the *only* manufacturer of both valves *and* discs. For drop-tight, trouble-free performance, get acquainted with the Fig. 106-A "family". Despite their extra value, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Ave., New York 17, N. Y. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

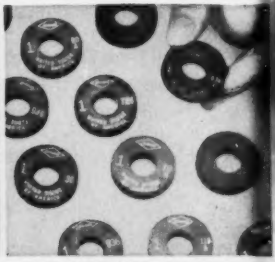


FOR LIFT CHECK SERVICE — Globe or Angle Bodies can be fitted with interchangeable Cap, Disc Holder, and Guide Disc Nut from Fig. 117A. Addition of spring from Fig. 655A provides spring loaded service.



FOR STOP & CHECK SERVICE — Use the 106A trim, but substitute this spindle from Fig. 630A and replace the regular disc nut with the check valve guide disc nut.

SLIP-ON, STAY ON DISC HOLDER — Any valve in the Fig. 106-A family can be quickly restored to new, drop-tight operating condition by slipping on a holder containing a new composition disc.



JENKINS MAKES DISCS for every need. Valve is regularly fitted with hard disc for saturated steam service. Other discs are made for hot and cold water, air, gas, gasoline, oil, acids, and other fluids.

Ask your Jenkins Distributor for the 106-A Series folder, Form 189-A, and the "Guide to Correct Disc Selection", Form 191. Or write: Jenkins Bros., 100 Park Ave., New York 17, N. Y.

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

"Cutoffs" in gas-shortage areas to protect service to domestic consumers will probably be left to judgment of local utilities. This was concensus of a meeting at which Gas Industry Advisory Council and Petroleum Administration for Defense discussed advisability of a general order establishing priorities for curtailment of industrial loads when an area's domestic service is threatened.

Complete regulation for lead — domestic, imported and scrap – is on the way. Domestic pig lead (one-third total supply) has been regulated since Sept 1. Lead imports (also one-third of total) go under regulation Jan 1. NPA is readying plans for scrap-lead control, to be put into operation as soon as possible.

Loss of Iranian oil has been pretty well made up, although aviation gasoline is in critical supply in some parts of Eastern Hemisphere. Industry experts believe oil products available in next five or six months should meet demands, barring worsening of the international situation. Fears of a fuel-oil shortage in northeast U. S. have subsided but there may be spot shortages if weather conditions hamper normal distribution. Stocks of residuals are higher than a year ago.

All-out rearmament and a complete reversal of the "guns and butter" philosophy isn't likely in an election year. But the current dustup over lagging arms production is almost sure to produce further tightening on civilian hard goods (short of a drastic ban), greater emphasis on materials and tools for defense production.

1951 peak power loads were met with a gross margin of 7 to 8%, according to early estimates. This is just about enough reserve to cover maintenance, emergency outages and system operating requirements. Going was tightest in Southeast and Northwest. Forecasts indicate this is last bad year for Southeast, but 1952 deficit in Northwest will probably be bigger than in 1951.

Big question is whether manufacturers can produce and ship scheduled equipment with materials allotments as short as they have been and look to be for some time to come. This "slippage" in deliveries, plus shortage difficulties plaguing the utilities making the installations, may pull down the reserve margins shown for 1952 and later in Edison Electric Institute's tenth semiannual survey. Indicated gross margins, based on median water conditions, are: 1952, 8.8%; 1953, 13.6%; 1954, 15.5%. In fact, says Defense Electric Power Administration's James M. Fairman, "during 1952 we can expect greater areas in which the power supply will be precarious."

Shortage of engineers will get worse before it gets better. Even after "bumper" graduating classes of 1950 and 1951, demand for engineers in foreseeable future is placed at not less than 40,000 graduates per year. The 1952 class will be a scant 25,000; classes for the next four or five years are estimated at 18,000–19,000.

Price of oil vs coal might take another swing, but it's an "iffy" question. If British and Iranians can get together, or if World Bank takes over Anglo-Iranian temporarily, as recently proposed, fuel-oil prices might slip. End of Korean hostilities would push in same direction. On the other hand, coal looks due for a rise if John L. Lewis can get another 10–15¢ per hour for the miners when contract renegotiation begins in March.

PUTTING *Air* TO WORK FOR JEFFREY MANUFACTURING

The Sturtevant E-R wheel resists abrasion.

No Maintenance IN *19* MONTHS

. . . A report from The Jeffrey Manufacturing Company

This report is familiar to the many satisfied users of Sturtevant Turbovane® Induced Draft (T.V.I.D.) Fans equipped with performance-proven E-R (Erosion Resistant) Wheels.

The Jeffrey Manufacturing Company selected *dependable* Sturtevant T.V.I.D. Fans for each of three pulverized coal-fired boilers in their modern new boiler plant at Columbus, Ohio. The decision to use E-R wheels was based on the fact that gases reaching these fans would contain abrasive fly ash. This decision is paying off in lowered maintenance and greater dependability for The Jeffrey Manufacturing Company, just as it has paid off for many other industrial power plants and major utilities throughout the country.

Westinghouse-Sturtevant Forced and Induced Draft Fans, with optional Vane Control® for part-load operation, are available in a wide variety of sizes and types; also, other air handling and electronic air cleaning apparatus. Put us to work *putting air to work* for you. Call your local Westinghouse-Sturtevant Office or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

YOU CAN BE SURE... IF IT'S Westinghouse

PUTTING *Air* TO WORK

J-80230

READER SERVICE SECTION

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PLANT EQUIPMENT NEWS 154
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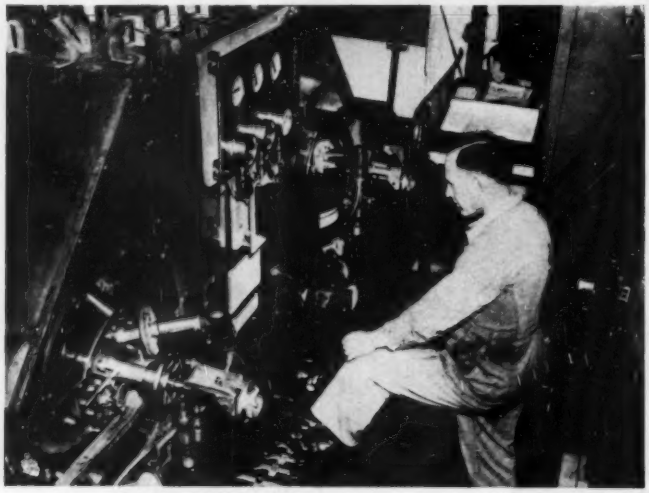


Oil Tanker Gives Gas Turbine Sea Trial

Sea trials safely under her belt, the 12,000-ton *Auris*, equipped with four diesel engines and one 1200-hp gas turbine, has begun regular runs between England and Texas. The gas turbine, built by British Thomson-Houston Co, can take the place of one diesel and has done so successfully for a 6-hr stretch on the initial tests

Atomic Energy for Building Heating

► In August 1948 the British scientific weekly, *Discovery*, reported that experiments in building heating with waste from an atomic pile were then underway. Recently the Ministry of Supply announced that their Harwell, England atomic research establishment is heating an 80-office building in just this way.

What they do is tap into their largest experimental atom pile, known as Bepo. Into the outlet duct of the pile's air cooling system they insert a heat exchanger. Water flows through this heat exchanger and feeds into a closed circuit supplying the space heating and domestic hot water requirements. Bypass fitted with an adjustable damper lets them vary the proportion of air flow through the heat exchanger.

At the moment results seem quite satisfactory. Cooling air leaves the heat exchanger at about 135 F and the water itself reaches 130 F. The heat load for this 80-office building amounts to a million Btu per hr, taking in a total floor area of 32,000 sq ft and a space volume of 330,000 cu ft. Further, the water is said to be free of radioactivity and can be safely used for washing.

The British plan to extend this heating system to take in two or possibly three more buildings at the Harwell establishment. All they anticipate is additional piping to the present heat exchanger. They expect its output to increase by 1952 when certain modifications to the pile are completed. Much higher air outlet temperatures will result, and, it is hoped, water temperatures leaving the heat exchanger will also be higher.

When the additional buildings come into the heating system the expected fuel saving will be about 1000 tons a year. This roughly amounts to a $7420 yearly savings against a $42,000 setup.

The possibility of atomic heating as an immediate threat to the more usual heating sources is very remote. Certainly few plants will be blessed with experimental atomic piles. But American industry will watch the Harwell experiments with great interest for the knowledge they are gathering on what materials will hold up in contact with a working atomic energy pile.

COMING EVENTS

Jan 14-17—Third Plant Maintenance Conference, Convention Hall, Philadelphia, Pa. Clapp & Poliak, Inc, 341 Madison Ave, New York 17, N. Y.

Jan 21-25—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, N. Y. H H Henline, secy, AIEE, 33 W 39th St, New York 18, N. Y.

Feb 7-8—Instrument Society of America, New York section, power plant symposium, Hotel Statler, N. Y. Richard Rimbach, chairman, 551 5th Ave., New York 17, N. Y.

Feb 28-29 — Pennsylvania Electric Assn, Prime movers and electrical equipment committees, Benjamin Franklin Hotel, Philadelphia, Pa. E Gordon, chairman, Potomac Edison Co, Hagerstown, Md.

Mar 24-26—American Society of Mechanical Engineers, spring meeting, Univ of Washington, Seattle, Wash. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

Mar 25-28—American Power Conference, Hotel Sherman, Chicago, Ill. Meeting chairman, R F Budenholzer, Illinois Institute of Technology, 3300 South Federal St, Chicago, Ill. Exhibit director, A F Thompson, 176 W Adams St, Chicago 3, Ill.

April 7-9—American Society of Lubrication Engineers, seventh annual meeting, Hotel Statler, Cleveland. J L Finkelmann, chairman, Warren Refining and Chemical Co, 750 Prospect Ave, Cleveland 15, Ohio.

April 14-18—Oil Heat Institute of America, 29th Oil Heat Exposition, Exposition Hall, Philadelphia, Pa. R H L Becher, mgr, OHI, 6 East 39th St, New York 16, N. Y.

Delaware River Aqueduct Develops Electric Power

New York's Board of Water Supply is expanding the city's domestic water resources by constructing a dam on the east branch of the Delaware River near Downs-

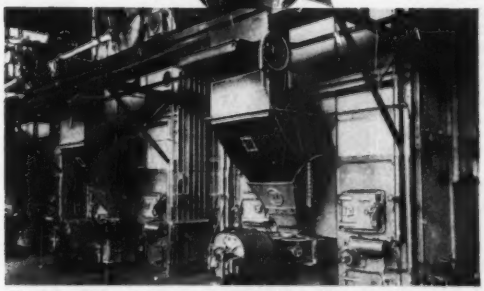
(*Continued on page* 186)

"Orchids to Oppenheimer!

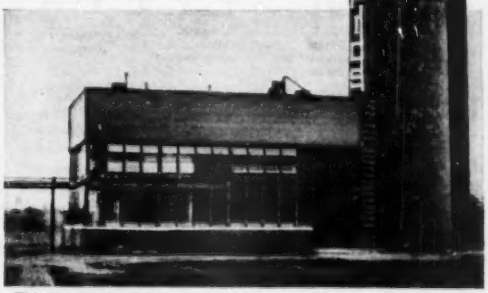
THAT NEW COAL HEATING SYSTEM HE DESIGNED SAVED $14,000 THE FIRST YEAR!"

says Carl R. Beckert, President, Thomas Young Orchids, Inc., Bound Brook, N. J.

"We're the largest orchid-growers in the world—Phil Oppenheimer is our consulting engineer. Had to have the most *dependable* heat we could find—steady, quickly available—to protect two million dollars' worth of orchid plants. Our new coal-fired plant gives us that kind of heat—in addition saved us $14,000 the first year! We've discovered that with modern equipment coal is as clean and automatic as any other fuel—and to do the job with oil would have meant an overall cost of 16% more! More than that, we can't take a chance on uncertain winter fuel deliveries. With *bituminous* coal we can store a year's fuel supply right on the ground."



The firing aisle at the new plant. This highly efficient coal equipment cut the company's fuel costs by 23%—is so completely automatic that it saved $6,000 the first year on labor costs, too!



This 300-ton silo that Young installed does away with former handling and shovelling costs. Coal is fed from the silo by a screw conveyor to each boiler's stoker-hopper—the coal is weighed on its trip.

- Use coal now? Get ALL coal's economy with highly efficient modern equipment. Building a new power plant? Find out how much more economical, efficient a job *bituminous* coal can do. Call in a competent consulting engineer. He can show you the modern coal-handling and combustion installations that will save most while meeting your particular needs. Remember you can count on *bituminous* coal! Of America's total fuel reserve—92% is coal! Even today oil is *imported*—while America can and does *export* coal! Ample coal reserves plus the outstanding efficiency of America's mining companies give coal users *the greatest possible assurance of a dependable fuel supply at stable prices.*

if you're running your own steam plant, here are just a few down-to-earth facts you can't afford to ignore!

COAL in most places is today's most economical fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

TECHNICAL BRIEFS

Latest engineering developments for busy power men

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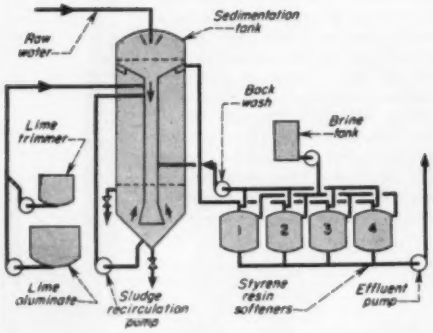


1 Hot-lime soda secondary zeolite system has operated for 18 months, giving the results shown in table at right

AVERAGE RESULTS: HOT LIME ZEOLITE

	Raw water	Hot lime aluminate softener effluent	Hot zeolite resin ion exchanger effluent
Hardness as $CaCO_3$			
Total	180	50	0.5
Calcium	110	43	0.4
Magnesium	70	7	0.1
Alkalinity as $CaCo_3$			
Phenolphthalein	—	16	18
Methyl Orange	144	30	34
Hydroxide	—	2	2.0
Phosphate as PO_4	—	—	—
Silica as SiO_2	3	0.6	0.5
Carbon Dioxide as CO_2	—	—	—
Dissolved solids	280	98	98
Turbidity as SiO_2	3	0.7	0.3
Alumina as Al_2O_3	Trace	Trace	Trace
pH	8.2	10.3	10.3

Water Treatment

Eighteen Months With Hot Lime-Zeolite. *By W S Butler, Dow Chemical Co.*

This plant began treating its makeup water by the hot lime-soda secondary phosphate process in 1943. After 1944, it shut down. In 1948, it started up again, and by Dec 1949, a hot lime-soda secondary zeolite system, Fig. 1, went in without disturbing physical layout of the plant.

There has been considerable controversy on the need for prefiltration. During chemical shortage, operation was attempted without a coagulant for a short period. At flow rates of less than 3 gpm per sq ft through the zeolite units, it was necessary to backwash about every 4 hr to keep units on the line. During this period, turbidities rose to 20 ppm in the primary softener effluent. From this experience, one can get by with no prefiltration only when relatively clear water can be fed to the Nalcite HCR softeners. If clear water can be produced with a good coagulant in an adequately designed primary softener, then prefiltration is not needed ahead of hot zeolite softeners. Certainly an operating advantage.

In large installations, cost of water treatment is important. Chemical cost, for complete hardness removal from 175-ppm-hardness water by the hot lime-zeolite system reported here, has been close to 2.6c per 1000 gal treated. This is close to theoretical cost, which would be 2.45c.

The hot lime-soda secondary phosphate system cost 3.75c per 1000 gal when treating this same water supply. *ESWP paper. No number.*

Power Generation

Forced-Air-Cooled Cables in Generating Plants. *By R W Burrell, A J Falcone, W J Roberts, Consolidated Edison Co.*

In generating plants where capacity has been increased, forced-air systems work out fine for cooling cables, according to the authors.

Consolidated Edison had to modernize its generator plants to keep pace with load growths. They had the choice of (1) adding ducts, changing size, type and number of cables, or using metal-clad bus, or (2) installing forced-air cooling to absorb the higher cable losses.

Forced-air cooling won out in some 15 generator units on the system. Cost was relatively low. A number of installations also were made on bus tie-in circuits, station runs of tie feeders and various other circuits where cables were operating above prescribed temperature limits. Another installation was made recently in an underground run in a generating-station yard where hot-spot conditions prevailed. Results are said to be good. *AIEE paper. No number.*

Progress in the Electric Power Industry. *By I E Moultrop and G A Orrok, Boston Edison Co.*

Discusses the major pieces of equipment — boilers, turbine-generators, switching, etc.—the role of design, the industry's future. An example of the authors' treatment follows:

From the very start of the power industry, progress has been to larger and larger units, operating at higher pressures and temperatures. Has there been a continuous improvement in efficiency? Actually, not of any great moment. Jimmy Watt's early boilers for pumping-engine service in England had test efficiencies of 86%, while today the newest and best boilers rarely exceed 90%. *AIEE paper. No. 51-382.*

Electrical Features of Automatic Hydro Stations. *By C L Gamble and A G Mellor, General Electric Co.*

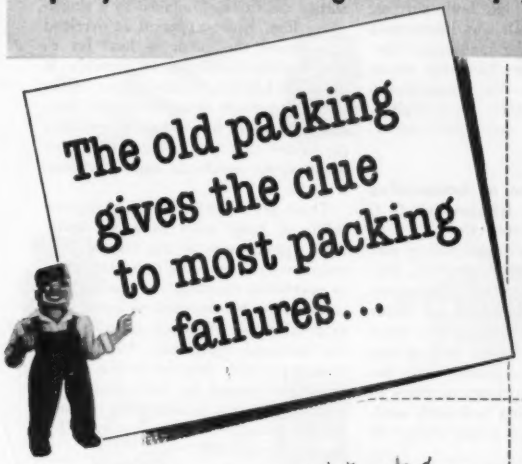
In a period of rising labor costs and a shortage of qualified personnel willing to accept full-time employment at remote station locations, the subject of automatic operation of hydroelectric power plants has top interest.

The authors' findings are:

1. Automatic features of hydro stations are very reliable and perform

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling



I was ruined by shaft misalignment. When old packing shows excessive reduction in cross-section directly beneath rod, shaft or plunger, bad alignment is indicated. Leakage usually occurs around top of shaft or rod. Cause may be worn bearings which permit shaft to whip.

Too much gland pressure did me in. Badly deformed rings next to the gland follower, with bottom rings in fair condition, suggest excessive gland pressure or improper installation. Excessive gland pressure sometimes causes packing to extrude between follower and rod or shaft.

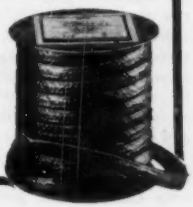
Lack of lubrication made things too hot for me. If the wearing faces of the rings are dried out or charred, with the rest of the packing in usable condition, the trouble probably is lack of lubrication. Excessively high operating temperatures and wrong type of packing can cause similar symptoms.

I'm worn out because I turned with the shaft. Unusual wear on the outside circumference of the packing almost always indicates one of two conditions. The rings may be binding on the shaft and rotating with it, or the packing is too loose in the stuffing box and moving with the rod.

Why you can count on Johns-Manville

INTERLOCKED ROD PACKING

Because it's braided square, not braided round and pressed square, J-M Interlocked Packing lasts longer . . . has a better contact area . . . makes a tight seal with medium gland pressure. J-M Interlocked is recommended for both reciprocating and rotating service, for use against steam up to 500°F; hot and cold fresh and salt water; oils; weak acids and caustics.



Your distributor will help, too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 290, New York 16, N. Y.

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Johns-Manville PACKINGS & GASKETS

More TECHNICAL BRIEFS

Begins on page 150

many functions better than manual operation.

2. The automatic features appreciably reduce generating cost per kwhr in many sizes and types of hydro developments.

3. The component equipment fits in well with automatic operation—accuracy and speed as compared to manual stations is improved.

4. Degree of automatic operation depends on factors like: (a) Size and importance of the station with respect to the power system. (b) Expected load factor. (c) Relative location in reference to other generating stations and to population centers. (d) Special hydraulic problems including supervision of dams and other hydraulic works, and ice and debris control problems.

5. Factory-assembled, packaged, automatic-control equipment reduces installation time and expense. *AIEE paper. No. 51-385.*

Electric Controls

Air-Break Contactors for Industrial Service. *By Leon J Goldberg, General Electric Co.*

Describes a line of air-break contactors for controlling 100- to 3000-hp motors on 2400-, 4160-, and 4800-volt systems. Their design features compactness, accessibility and long life. The arc-rupturing structure has a magnetic blowout and an arc chute that confines the arc entirely within its boundaries.

Industry has steadily expanded its use of higher-voltage motors and has broadened its requirements for controlling them safely, conveniently, and economically. Although many motors are started directly across the line and run at a single speed, other units use reduced-voltage to start, have multiple speeds, dynamic braking, or run in reverse. Typical applications are drives for rubber mills, plastic mills, large air compressors, hydraulic system pumps and mine hoists.

Controllers for these motors, besides starting, stopping and providing running control, must give much better protection against overloads and faults than the older and smaller equipment. This is a consequence of (1) the greater potential damage that faults can cause on large and stiff power systems as compared with the small and soft systems formerly more often encountered (2) greater recognition of the potential damage from equipment that does not render complete fault protection.

Equipment containing components damageable under high fault current, even though the fault was interrupted successfully, would be dangerous. Likewise, modern industry has more severe requirements as to life, compactness, and ease of maintenance. So controllers must be better than ever. *AIEE paper. No. 51-376.*

Automatic Protection of Refrigerating Machines. *By T C Johnson and G C Wedel, General Electric Co.*

Growth of the air-conditioning and commercial-refrigeration business during the last few years emphasizes several important problems of motor application and control. Since these problems often require the help of municipal authorities, national code authorities, and standardization efforts of the major engineering technical societies, the authors hope a free discussion will benefit all.

A motor driving a refrigeration compressor is essentially no different from one driving any other machine. The overload protective device must protect the motor from stalled conditions imposed by a faulty driven machine, frozen bearing or something similar. On polyphase motors, it must protect against stalled conditions produced by a single-phase line. It must prevent an overload that causes the motor to heat for so long that the insulation deteriorates. It must also allow the motor to stay on the line long enough to accelerate the load, and must not be set so close to operating conditions that short intermittent and undamaging overloads cause nuisance tripouts.

These are no different from requirements of many other kinds of equipment, but because of the varying load conditions it is possible to operate close to maximum capacity. So each application must be designed as accurately as possible for efficiency, especially of the electrical equipment. Usually the cooling capacity required of the driven equipment cannot be determined with anything like the precision for measuring the possible motor output. *AIEE paper. No. 51-380.*

Rectifier Application for Steel-Mill Drives. *By George B Scheer, Kaiser Industries, Inc.*

Briefly discusses original method of obtaining constant potential dc power using motor-generator sets. Reasons for subsequent use, two years later, of rectifiers for obtaining dc power are reviewed in more detail. Brief discussion of both theoretical and operating advantages and disadvantages is made and, in particular, comparison is given showing relative initial use of materials and cost for efficiency, operation and maintenance.

Discusses use of rectifiers for furnishing power to drive a merchant mill. Mill at Fontana, Calif, has 2600-kw rectifier and buck boost generator working in conjunction with it. Mill was installed in 1946 and was one of the earliest to depend 100% on use of a rectifier. Newest installation, 86-in. 4-stand hot-strip mill, driven by three 5000-hp motors and one 3500-hp motor with power supplied by two 5000-kw rectifiers with watercooled pryanol transformers, is discussed. Included are operating cost, space saving, material, effect on motor room-ventilating equipment, power factor, impact loading, speed control, acceleration and deceleration.

Although Fontana has probably greater percentage of rectifier equipment than any mill in the country, particular emphasis is placed on its limitations and the necessity to use caution

(*Continued on page* 166)

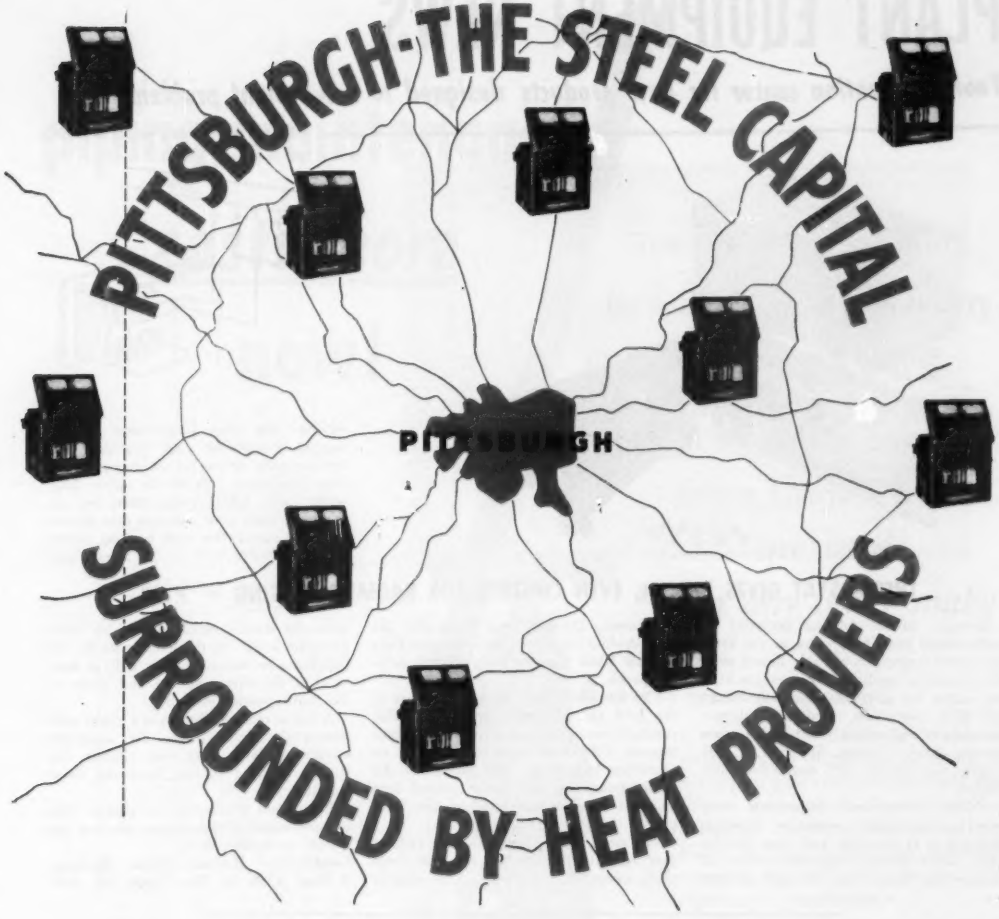
TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Institute of Electrical Engineers, fall general meeting, Cleveland Hotel, Cleveland, Ohio, Oct 22-26, 1951. Identified by initials AIEE, 33 W 39th St, New York 18, N. Y.

Association of Iron and Steel Engineers, annual meeting, Hotel Sherman, Chicago, Ill. Oct 1-4, 1951. Identified by initials AISE and obtainable through AISE as reported in the Iron and Steel Engineer, *1010 Empire Bldg, Pittsburgh, Pa.*

Engineers Society of Western Pennsylvania, annual meeting, Wm Penn Hotel, Pittsburgh, Pa. Oct 22-24, 1951. Identified by initials ESWP and obtainable in Proceedings, through W M Porter, secy, ESWP, Hotel Wm Penn, Pittsburgh, Pa.



When your eye is on Pittsburgh—and three dozen towns in its orbit—you're spotting scores of furnace operations regularly checked by Cities Service Heat Provers. Here, where they know all kinds of furnace instruments, and where high efficiency is most urgent today, the application of Heat Provers by Cities Service is increasingly valued.

It takes the Heat Prover to read simultaneously for oxygen and combustibles, measured direct by actual gas analysis. And the Heat Prover's continuous rapid sampling reveals effects of furnace adjustments at once. The Heat Prover frees you of maintenance too, because it's *not an instrument you buy, but a Service we supply*. Learn how it can raise productivity for you . . . in iron, steel, ceramics, glass, cement or any other furnace operation. Write CITIES SERVICE OIL COMPANY, Dept. A22, Sixty Wall Tower, New York City 5.

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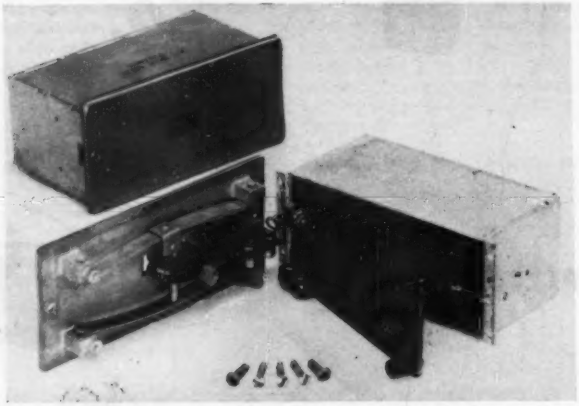
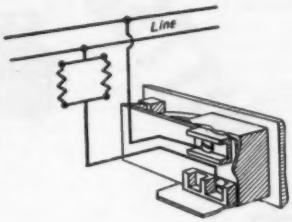




Across - the - line connections for this rugged thermostat save the cost and maintenance of relays or transformers. One thermostat can handle up to 2000 watts load. Single installations act exactly like open-close switches and are put in series connection with heating panels and thermostat both in the same room.

THERMOSTAT GIVES PRECISE, EVEN CONTROL FOR RADIANT HEATING • P128

Because radiant heating performs its work almost exactly opposite to the usual convection system, its controls should show this change in conditions. Convection heating warms by about 20% radiant energy and 80% convection. Radiant heating—particularly with recently introduced, glass heating panels (POWER, *Nov 1951, p 124*)—turns this around, 20% convection, 80% radiant.

Many conventional thermostats have their temperature sensitive elements shielded so radiant-heat pull from near-by walls won't distort temperature-effect of surrounding warm air. Because of this shortcoming the Mulvaney *Radiantrol* has been drafted for service with the new Continental Glass Heating Corp electric heating panels.

The Radiantrol is a proven performer in the food and pharmaceutical fields. For comfort heating it controls room conditions through differential expansion between an aluminum front plate, fully exposed to the room atmosphere, and invar control bars mounted between the ends of the front plate.

Any drop in air temperature or radiant heat conditions cools the sensitive front plate, causes it to contract. This slightly bows the invar control bars which lower a contact lever. As the lever nears the ON position a permanent magnet pulls it down to close the silver contacts and throw on the heat-supplying element.

A rise in room conditions to a preset point warms the front plate. Its expansion straightens invar bars very slightly, but enough to raise contact lever and break circuit.

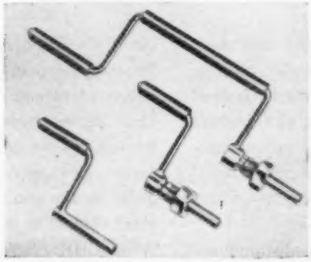
Relays and transformer are absent. This thermostat works right across the line, can handle up to 2000 watts.

Continental Radiant Glass Heating, 1 East 35th St, New York 16, N.Y.

FORK TRUCKS P127

Hydraulically operated clamping forks can be fitted with self-aligning rubber faced gripping pads to handle cylinders.

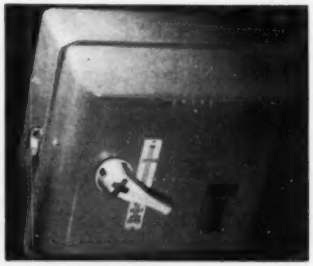
Lewis-Shepard Products, Inc, 191 Walnut St, Watertown 72, Mass.



INSTRUMENT WINDER P101

Twisting a key to wind up a clock, meter or other spring-wound control instrument is eliminated by new gadget called the Campbell *winder-upper*. Key becomes a crank. It's made in three types. Simplest, Type A, consists of a key end and crank. Type B includes a torque chuck with slip-grip arrangement.

J A Campbell, 645 E Wardlow Rd, Long Beach 7, Calif.



MOTOR STARTER P110

Combination across-the-line motor starter with circuit breaker. Components are mounted *side-byside*. Developed for use where this mounting is desired for reasons of space and arrangement. Starter has same self-indicating slamproof handle as the standard design with vertical-mounting.

Available in Sizes 0, 1, and 2 in sheet-steel enclosures for NEMA Types I, IA, and V. Modifications like built-in control

For more data on these items, use post cards, p 163. Identify request with P and number.

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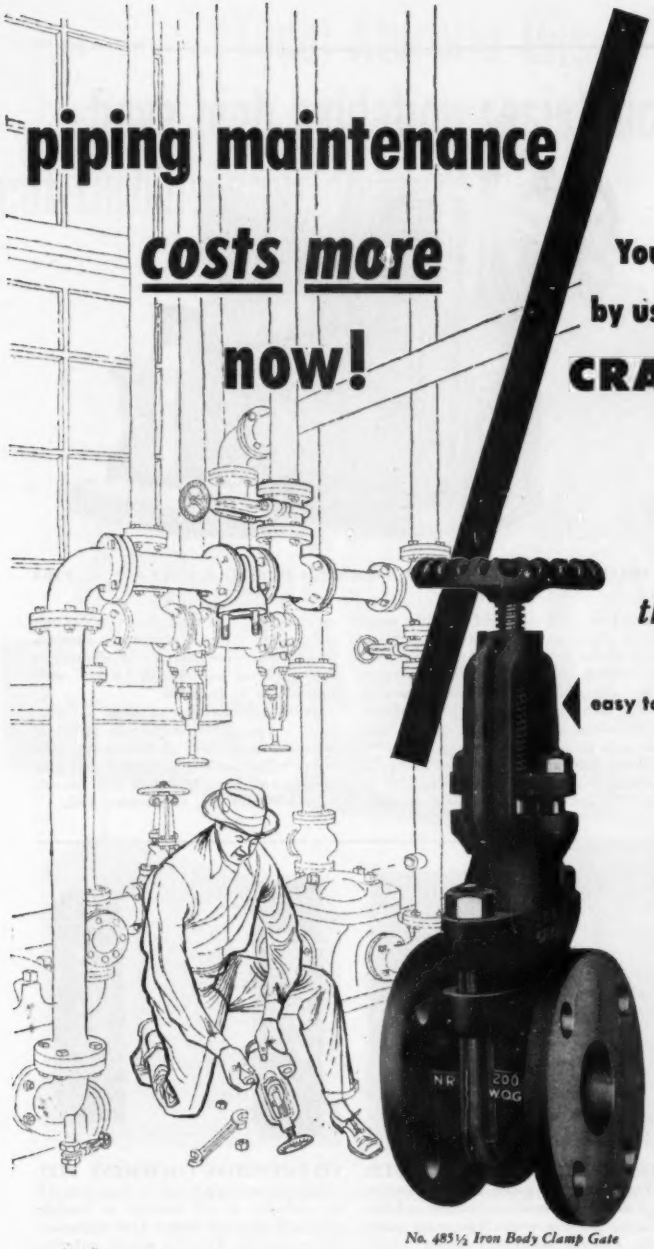

No. 483½ Iron Body Clamp Gate

easy to open for inspection

It's no trick to dismantle this clamp gate valve for inspection, cleaning, or servicing. Just remove two nuts and lift out the complete bonnet and disc assembly. The body stays in the line. Reassembling is just as easy. Repeated opening does not affect bonnet joint tightness or alignment.

A real time and labor saver on lines needing periodic cleanout, Crane Outside Screw and Yoke Clamp Gates are made in materials suited to a variety of services. Also Inside Screw with rising stem and Quick-Opening Patterns. Choice of flanged or screwed ends.

For complete valve suitability at lower ultimate cost, you're better off with Crane Valves. Ask your Crane Representative for demonstration.

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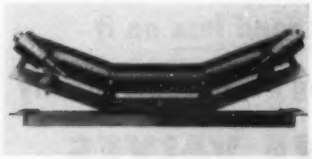
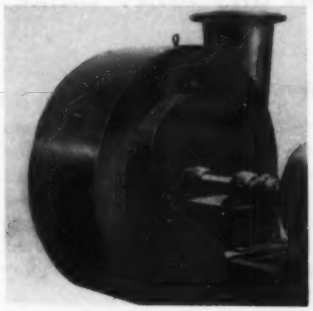
circuit transformer, *start-stop* pushbuttons, *hand-off-auto* selector switch, control relay, extra electrical interlocks, and inductive shunts can be supplied on special order. **Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**



TRAINING ROLLER P125

Ready response to any shift of a conveyor belt off dead center gives this set of training rollers ability to tilt the carrier into an angular position with respect to belt travel. Tilt is enough to return the belt to dead center and carrier resumes its normal position. For best results these rollers are installed every 50-100 ft.
Stephens-Adamson Mfg Co, Aurora, Ill.



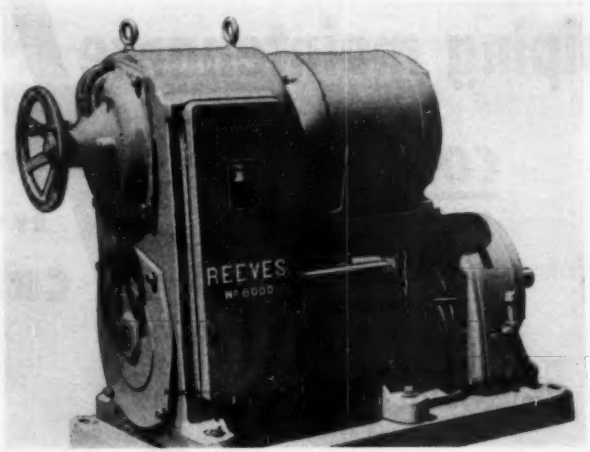
STEEL BLOWERS P126

Standard models, up to 200 hp, fabricated steel blowers put together with the latest continuous welding methods give considerable weight and space savings over the old cast blower construction. Three styles, models SG (multi-stage) and SM (single-stage) at 3500 rpm, and ST at 1750 rpm. Standard outlet pipe sizes from 4 to 24 in., flange fitted, can be connected in any of 14 positions depending upon the discharge angle and offset required.
Billmyre Blower Div, Lamson Corp, Syracuse, N.Y.

SURFACE COATING P121

Improved surface maintenance results from brush or spray application of stainless steel coating said to protect metals against rust, corrosion, deterioration by salt air and water, industrial fumes.
Steelcote Mfg Co, St Louis 3, Mo.

For more data on these items, use post cards, p 163. Identify request with P and number.

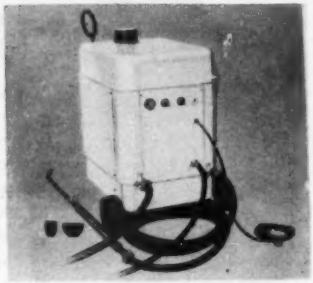


VARIABLE SPEED ELEMENTS PACKAGED IN SINGLE UNIT P104

Complete, self-contained variable speed power plant, new size Vari-Speed Motodrive Model No. 8000, gives the plant man all essential elements in a single, compact space-saving assembly permitting installation in many hard-to-get-at spots. Offered in horizontal and vertical designs to provide even greater flexibility.

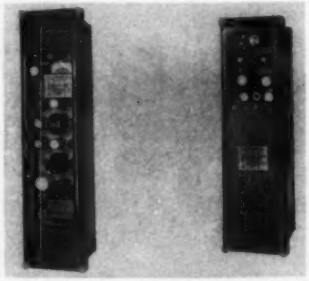
Model 8000 has a capacity of 25 hp; is available in all speed ranges from 2:1 to 6:1. User can select any standard constant-speed motor. It is then placed in the unit along with the manufacturer's standard speed-varying mechanism. If desired, a built-in helical gear reducer for low speed outputs can be included.

Handwheel control is standard, but electrical or completely automatic hydraulic controls can be had. A tachometer, calibrated to the user's specifications, may also be attached when operation will benefit. **Reeves Pulley Co, Columbus, Ind.**



STEAM CLEANER P118

Ten times faster grease and dirt cleaning than with bucket-brush-and-scraper or hand-cleaning methods results from using model F-15, *Fireless Hy-Steam-Pressure Jenny*. Operates on any steam supply from 60 to 150 psi. Cleaner is portable; rolls on wheels; weighs about 240 lbs; measures 37 in. long by 27 wide by 37 high; furnishes from 45 to 90 gal per hr. After connecting to water, steam and 110 v 60 cycle ac lines, unit is ready to go to work.
Hypressure Jenny Div, Homestead Valve Mfg Co, Coraopolis, Pa.

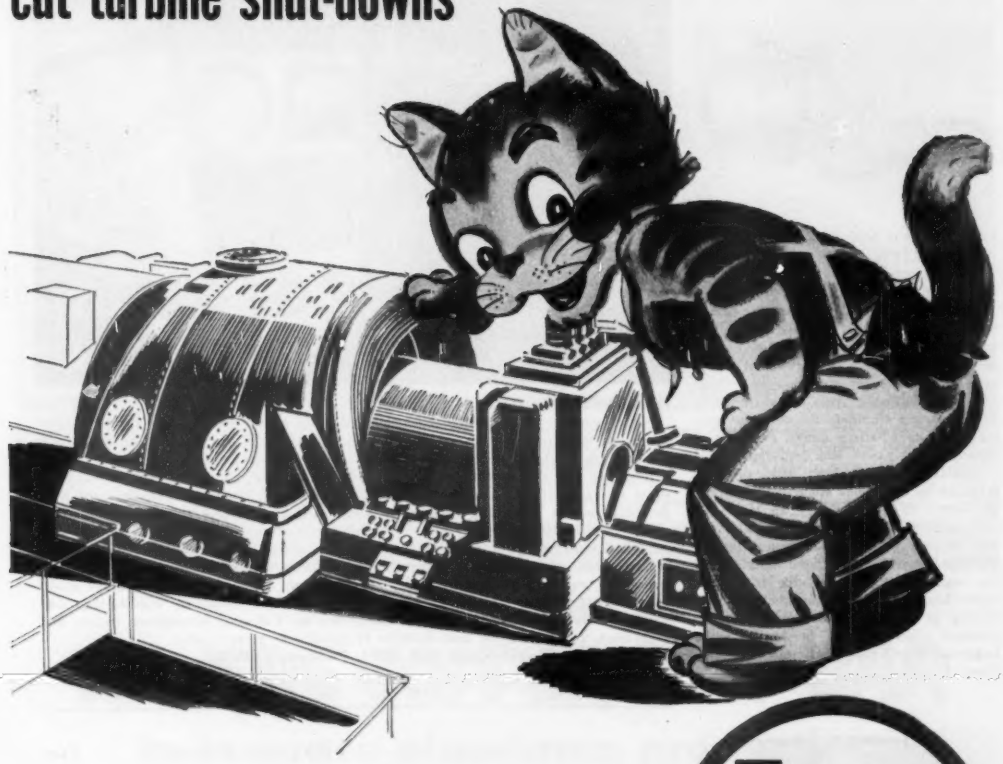


TELEMETERING EQUIPMENT P111

Fast telemetering response (less than 0.3 sec exclusive of end devices) is possible with millivolt-input *Freq-O-Tron* telemetering equipment. Provides remote metering of any quantity that can be converted to a proportional millivolt quantity. Transmits any value by use of a microwave, power line carrier, or pilot wire medium.

Flexible operation allows totalization of similar quantities at the measuring stations, intermediate stations, or receiving stations. Calibrated to the customer's requirements and can be supplied as a complete instal-

"Tycol Aturbrio Oils have high oxidation resistance... cut turbine shut-downs"



Tycol Aturbrio Oils are unexcelled for long turbine life. They provide resistance to oxidation and protect against corrosion.

Further, Aturbrio Oils have excellent demulsibility properties. Turbine Operators using Aturbrio report minimum wear . . . utmost turbine efficiency . . . greatly decreased maintenance costs.

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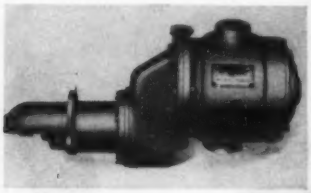
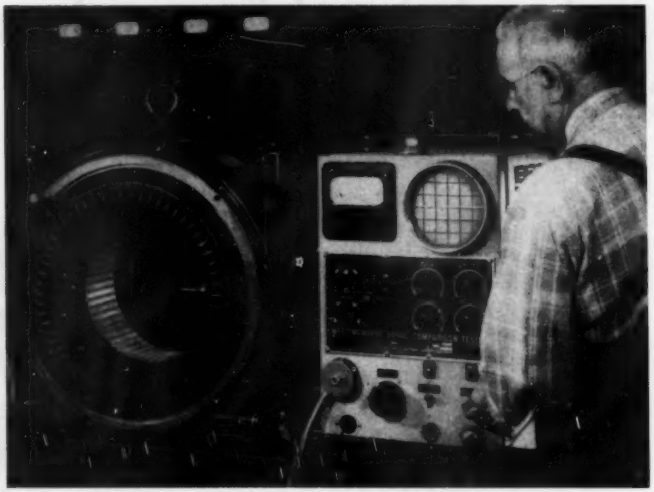
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



DIESEL AND GAS-ENGINE AIR STARTING MOTORS P132

Smaller and more compact than equivalent electric starters these air starting motors are designed for cranking diesel and gasoline engines with piston displacements up to more than 3500 cu in. Though normally operated by compressed air, they are also suitable for operation on natural gas when available at sufficient pressure. These starters eliminate the need for generators, storage-battery banks, and cost of battery maintenance and replacement.

Available in two sizes; 9BM develops up to 16 hp and needs about 7 cu ft of air per start; 20 BM develops up to 41 hp and needs about 16 cu ft of air per start. Smaller unit weighs 40 lb, larger 103 lb. Multi-vane air motor of the unit cranks the engine through a Bendix drive. Air motor has a solid hardened-steel rotor revolving in a cylinder of hardened wear-resistant alloy enclosed by bronze ends.
Ingersoll-Rand Co, 11 Broadway, New York 4, N.Y.



ONE TEST SET-UP GIVES FULL INSULATION STORY P112

New electronic surge comparison tester wraps up all the answers you need for most insulation tests with one test set-up. Used principally to locate insulation faults and winding dissymmetries in motors, ac and dc generators, transformers and coils.

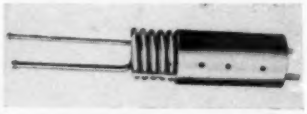
Available in either mobile or portable units. It is compact, moveable; has adequate surge voltage characteristics for most insulation tests. Simplicity of operation plus wide flexibility makes this surge tester adaptable to either manufacturing or repair work.

It simultaneously tests turn-to-turn, phase-to-phase, and coil-to-ground insulation with potentials high enough to simulate power circuit transient stresses.

With every test setup, high-frequency and high-potential qualitative tests of resistance, impedance, and turn balance are made, and results are obtained by a single scope observation. High turn-to-turn voltages are applied without excessive winding-to-ground stresses. Non-destructive testing is assured even on fractional horsepower motors and generators, and destructive fault location is possible in many cases.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa

VENTILATOR P130

Whirlout straight-through roof ventilator is available in a wide range of sizes and capacities. Ventilator is open only when its propeller fan is operating. Air stream holds two semi-circular halves of damper open while forcing unwanted elements out of building. Streamlined fan ring directly above square-tipped propeller guides the air stream smoothly without backflow.
The Swartwout Co, Cleveland 12, Ohio



TANK PREHEATER P119

All steel, shell and coil assembly liquid tank preheater for bulk storage, the *Hot Spot* rests on bottom of the tank. Suction pipe and inlet and outlet pipes for heat, either steam or hot water, go through the manhole cover. Proper length inlet and outlet pipes fit any diameter tank. New model fits in 14½ in. dia manholes or greater. Completely tested with 400 psi air pressure under water before shipment.

Special flow accumulator causes the heavy oil or other liquids to flow over heated pipes before entering the suction line. Heating action raises liquids to proper flow temperature and thereby reduces suction-pump load.
Rempe Co, 340 N Sacramento Blvd, Chicago 12, Ill.

PRECISION TUBING P123

Fine drawn, precision low carbon, welded and drawn steel tubing can be substituted in many places for non-ferrous and alloy metal tubing. New line is accurately drawn to close tolerances of inside diameter and wall thicknesses. Available in a range of outside diameters from 0.5 to 0.010 in. with wall thickness down to 0.0015 in.
Precision Tube Co, 3824 Terrace St, Philadelphia 28, Pa.

COMPACT VOLTAGE REGULATOR P103

More compact version of the *rocking contact* voltage regulator for small ac generators. Latest unit is available in two ratings, one with a 34-step commutator (Type V-00), the other with 50 steps (Type 221).

Regulator has been reduced in overall size, occupies less switchboard space. Meter-like in appearance, it is semi-flush mounted to match switchboard instruments. Has built-in voltage adjusting rheostat and

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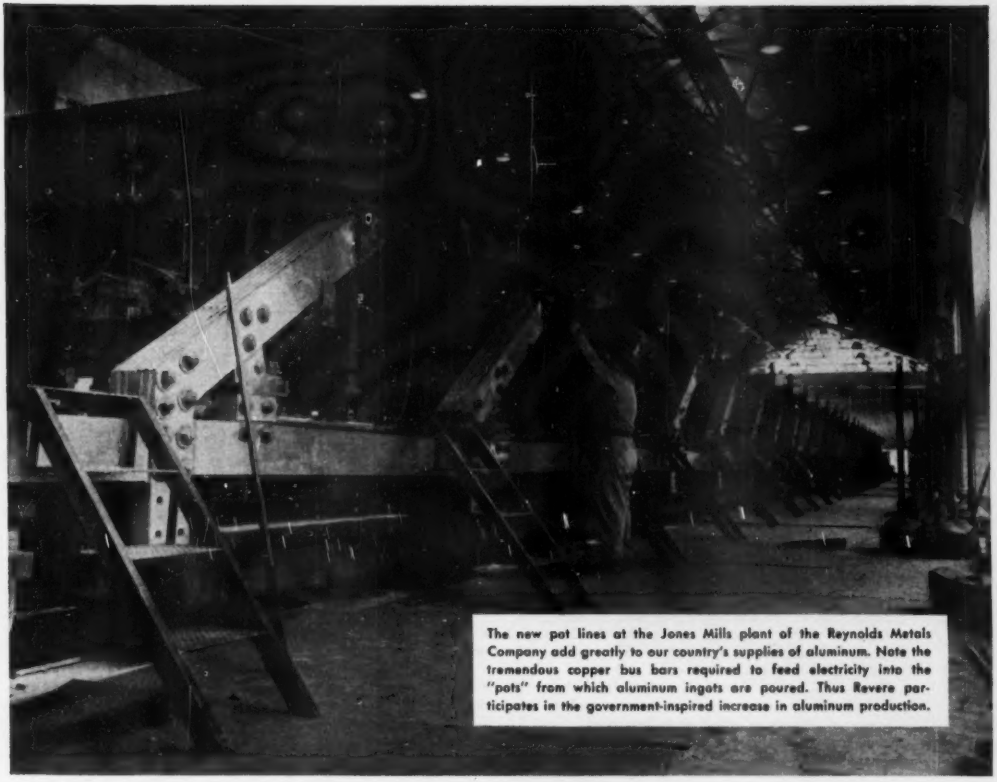

The new pot lines at the Jones Mills plant of the Reynolds Metals Company add greatly to our country's supplies of aluminum. Note the tremendous copper bus bars required to feed electricity into the "pots" from which aluminum ingots are poured. Thus Revere participates in the government-inspired increase in aluminum production.

It takes a lot of REVERE COPPER BUS BAR to increase aluminum production

● The Government has directed Revere to produce millions of pounds of copper bus bar for the new aluminum plants being put into operation in order to increase the output of this light metal that is so essential to defense. Copper is the ideal metal to carry the heavy currents required for the "pots" that produce aluminum from the ore. Thus aluminum and copper are intimately linked together. Aluminum is used in planes, ships, weapons, missiles, ammunition, and in many other defense applications. Copper, best of all the commercial metals in electrical conductivity, likewise has many vital tasks to perform for our armed forces, afloat, ashore, and in the air.

Revere is glad that its large capacity for the production of bus bar is so valuable in these times; in our long history of over 150 years of service we have always given everything possible in times of our country's need. However, we are regretful that today's government requirements materially limit our ability to fill civilian orders. We look ahead, eagerly and hopefully, to the time when the present urgent demands are met to such an extent that orders for bus bar and other Revere products can be filled more promptly.

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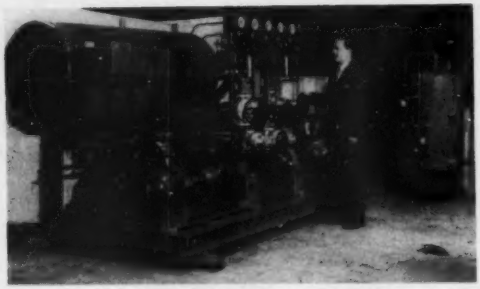
More EQUIPMENT NEWS

Begins on page 154



LIQUID-PHASE HEAT-TRANSFER EQUIPMENT P131

Offered as individual components or as "tailored" package units for smaller installations, this line of liquid-phase heat-transfer equipment operates at temperatures up to 800 F. Coal-, oil- or gas-fired boilers with capacities up to 20 million Btu per hour are designed for high circulation temperatures and high flow velocity to avoid overheating liquid transfer medium.

Special centrifugal pumps used are rated to 1600 gpm. Package units, mounted on a common frame, have electric heaters with 3 to 75 kw capacity. Or gas heaters with ratings of 250,000 to 1 million Btu per hr may be used. Package units may also be adapted for oil firing. Circulating pumps for these units have capacities of 1½ to 120 gpm, depending on size.

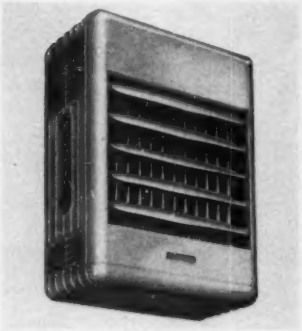
Controls of the equipment may be for the heating phase alone or can combine heating and cooling. They may also be interconnected with other variables of speed and time.

Three heat-transfer liquids are used; Hydrotherm 500, 700 and 800. All operate at atmospheric pressure and each has definite temperature ranges in which it is best used.

American Hydrotherm Corp, 33-70 12th St, Long Island City 6, N.Y.

CHECK THESE TOO!....

Electrical Insulation Tester ..... p 170
Adjustable Air Diffuser ..... p 172
All-Around Surface Thermometer ..... p 172
Electrical Sealing Compounds ..... p 174
Stainless Steel Globe Valve ..... p 174
Motor Starter, built-in light ..... p 178
Small Submersible Pump ..... p 178



GAS-FIRED UNIT HEATERS P133

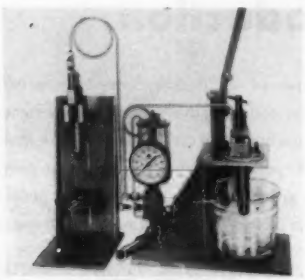
These compact and lightweight gas-fired unit heaters are offered in five sizes ranging from 65,000 to 165,000 Btu per hour input. Heat exchanger and burners are stainless steel for maximum resistance to rust and the acid action of corrosive gases. Die-formed heat-exchanger tubes are their own individual combustion chambers. Each tube is individually fired.

Modine Mfg Co, Racine, Wis.

(*Continued from page* 158)

is of dust-proof design with all moving parts totally enclosed.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



DIESEL NOZZLE AND INJECTOR TESTER P138

Specially-developed for heavy-duty diesel power, this unit permits fast accurate tests of a large number of different make nozzles and injectors. Combination set has simplified fixtures, a test pump and suitable fuel-line connectors. Among the makes of nozzles and injectors that can be tested are Electro-Motive, American Bosch, Bendix-Scintilla, Fairbanks, Morse; Ex-Cell-O, Adeco and Demco.

Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.

INDUSTRIAL HOSE P134

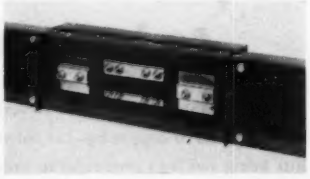
Abrasoflex multi-purpose industrial type-hose is both oil- and abrasion-resistant. It can be used for any of eight industrial applications including air, welding, cold-water, hot-water, paint-spraying, oil-spraying, grease and gasoline. Available with a black cover with 1- or 2-braid high-tensile reinforcement in seven sizes ranging from 3/16 to 1 in. inside diameter suitable for 250 psi pressure.

Mercer Rubber Corp, 66 Reade St, New York, N.Y.

ELECTRICAL INSULATION P102

Silicone resin coated *Novabestos* is only .003 in. thick. But it can be used at operating temperatures of 180 C, putting it in the category of Class H insulation. Composed of 97% pure asbestos and 3% organic material.

Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N. J.



BUS DUCT P114

Joint design in their feed-in duct makes it unnecessary to match left and right-hand duct ends. All ends are identical in construction. Duct is available in capacities of 600 to 4000 amp.

Square D Co, 6060 Rivard St, Detroit 11, Mich.

PROTECTIVE WRAPPING P117

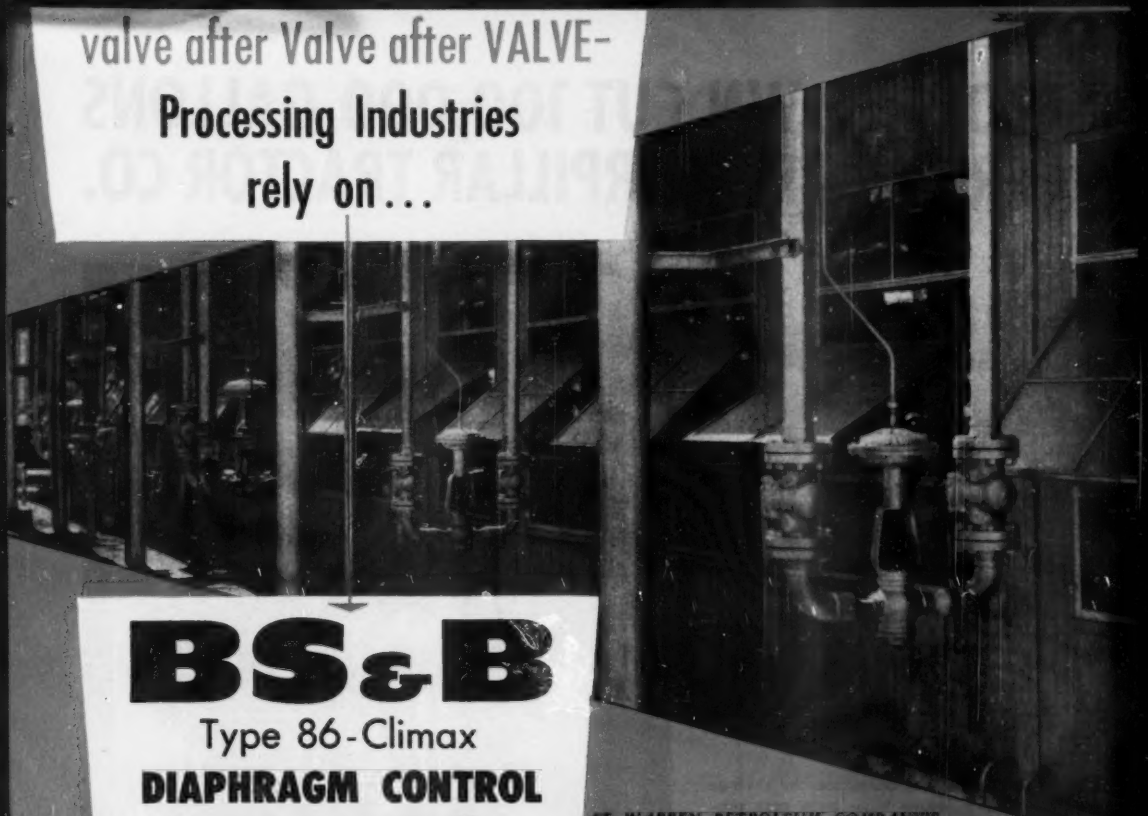
Unfinished ferrous metal parts can be left overnight and weekends fully protected from rust. All that needs be done is to line the storage bin with *Vapor Wrapper*, a rust-inhibiting paper impregnated with *Callex*, a volatilizing chemical that inhibits moisture-action. A covering sheet over the

(*Continued on page* 170)

For more data on these items, use post cards, p 163. Identify request with P and number.

valve after Valve after VALVE-

Processing Industries rely on...



BS&B

Type 86-Climax DIAPHRAGM CONTROL VALVES

AT WARREN PETROLEUM COMPANY'S big, ultra-modern Gladewater, Texas refinery, Climax valves and controls are standard — as these Type 86R fuel gas regulators.

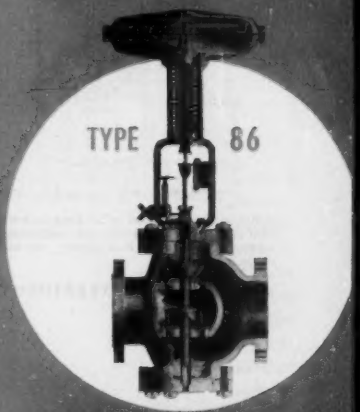
Control of flow, liquid level, pressure and temperature is best achieved by BS&B's Type 86 Climax valves—whether the medium is air, gas, vapor liquid or steam. In any industries where trouble-free performance and ease of maintenance are important—Climax 86 valves have proved their reliability and versatility. BS&B Climax control valves feature wide range, high-lift, true-aligned, reversible inner valves, minimum hysteresis, chattering and shock. Bolted down yokes give added strength so valves can be installed in any position. Face-to-face dimensions of flanges are standard.

A Climax Type 86 is available to you for any control application—with single or double port, reversed topworks, single or double diaphragm, with hand wheels, finned cooling section, purged gland section, bellows stem packing, steam jacketed valve bodies and valve positioners. Pressure ranges are from 125 to 5000 psi; sizes range from ½" to 4" in single port, ½" to 16" in double port valves.

The superiority of Climax valves does not depend alone on their unique design—but on the exacting accuracy of their manufacture, accuracy that demands close tolerances for acceptance by BS&B's Climax Controls Engineers.

CLIMAX CONFIDENTIAL ENGINEERING SERVICE

is available for all your control problems. You need not hesitate to call on Climax Engineers for assistance—BS&B's reputation for 58 years of customer service stands behind them. Write today for complete, illustrated literature on the construction, specifications and application of Climax Diaphragm Control Valves.



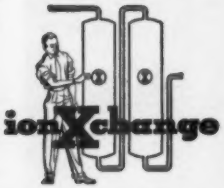
CLIMAX BS&B CONTROLS

BLACK, SIVALLS & BRYSON, INC.

CLIMAX CONTROLS DIVISION DEPT 441

7500 EAST 12TH STREET KANSAS CITY 3, MISSOURI

BLOW-DOWN CUT 100,000 GALLONS PER DAY AT CATERPILLAR TRACTOR CO.



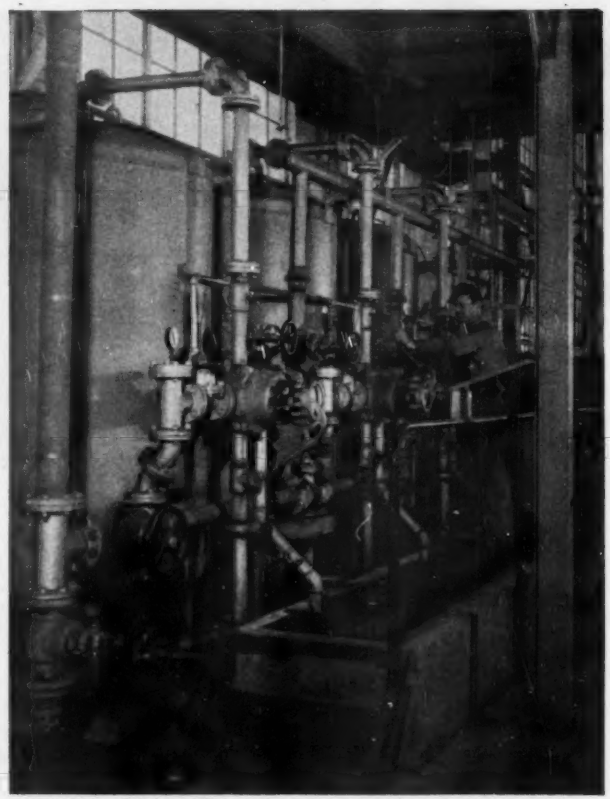
ILLCO-WAY's simplified modern boiler water conditioning system cuts steam costs, boosts efficiency at Caterpillar Tractor Co. plant

"Caterpillar" operates twelve 630 H. P. boilers on de-alkalized water. The boilers can be operated at 200% capacity, or at 1260 H. P.

Use of ILLCO-WAY equipment, shown at right, has reduced blow-downs by approximately one-half of former requirements. Continued use of de-alkalized water is expected to produce even greater blow-down reduction in the future.

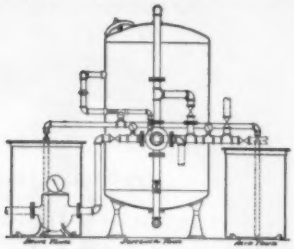
In nine months of operation the savings on make-up water have been very pronounced, Caterpillar reports. During normal operations, an estimated 100,000 gallons per day on make-up water are saved by using ILLCO-WAY equipment, as the result of elimination of excessive blow-down.

ILLCO-WAY De-alkalizing equipment produces water suitably low in alkalinity, reduced in solids content, free of hardness, at a cost comparable to softening. See Sweet's File, Engineering, or write us.



ILLCO-WAY De-alkalizing installation in power plant at Caterpillar Tractor Co., Peoria, Illinois

ILLCO-TEMP SOFTENER...for "zero" soft boiler feedwater without chemical after-treatment



Softener is easily added to hot lime-soda water softener. Unit operates economically and continuously at temperatures as high as 250° F or higher... on waters having a pH as high as 10.5.

This modern softener removes residual hardness from the effluent of hot or cold lime-soda units—*without chemical after-treatment.* Chemical savings from this alone will normally pay for equipment in less than 2 years. Reduction of effluent from lime-soda units to "zero" hardness produces real operating economies. Scale-forming salts are eliminated. No after-precipitation in the lines, pumps, pre-heaters, or the boilers themselves.

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

ILLINOIS WATER TREATMENT CO., 853-1, Cedar Street, Rockford, Illinois • 141 East 44th St., New York City

Canadian Distributor: Pumps & Softeners Ltd., London, Ontario

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FREE CATALOGS AND BULLETINS

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

B1 GAS AND DUST MEASUREMENTS—24-page technical bulletin gives methods for determining velocity, volume, dust and mist content of gases. Outlines a standard procedure for studying gas streams in industrial fine systems. Bulletin WP-46. Western Precipitation Corp, 1016 W 9th St, Los Angeles 15, Calif.

B2 AIR CONDITIONING—Also air handling and air cleaning equipment. 16-page, condensed, full-line catalog No. M-6114. Gives construction details, dimensions, capacities, photos, operating instructions. Dept 7, Sturtevant Div, Westinghouse Electric Corp, Hyde Park, Boston 36, Mass.

B3 AMMONIA COMPRESSORS — Enclosed design, cylinders from 3 in. by 3 in. to 17½ in. by 12 in. 16-page bulletin No. 113-1 gives space requirements, construction features, shows installations. Frick Co, Waynesboro, Pa.

BOILERS AND AUXILIARIES

B4 BURNERS—For oil or gas. 14-page bulletin pictures and describes dry steam-atomizing principle; shows installations. Lammert & Mann Co, 1753 Wallace St, Chicago 12, Ill.

B5 DUST RECOVERY—4-page catalog No. 101. Explains need for dust recovery, illustrates line of precipitators and collectors, fundamentals of operation, diagrams, installation photos. Buell Engineering Co, Inc, 70 Pine St, New York 5, N. Y.

B6 PACKAGED BOILERS—3 models, capacity 6100 to 33,500 lbs of steam per hr, at 100 psi. 8-page folder gives construction specifications, advantages, applications. Wm Bros Boiler & Mfg Co, Boiler Div, 1667 10th Ave SE, Minneapolis 14, Minn.

ELECTRICAL AND MECHANICAL CONTROLS

B7 VOLTAGE REGULATORS — Application, construction, and operation; recent control features for small ac generators. 4-page bulletin No. 14B6142A. Allis-Chalmers Mfg Co, 811 S 70th St, Milwaukee, Wis.

B8 CONTACT CONTROLLERS — Vane-type units give snap-action on-off 2- or 3-position control. Pipeline action eliminates control lag. 16-page catalog No. 4008 gives specifications, photos, operating principles. Simplicity and low cost make them useful for limit-type signaling and control. Minneapolis-Honeywell Regulator Co.

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More FREE BULLETINS

Begins on page 163

Brown Instruments Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

B9 SERVOMECHANISM TECHNIQUES — Basic information on analysis of automatic control problems in industrial process instrumentation. Advantages of the method are discussed. 24-page booklet No. G-56. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

★ MICROMETER POSITIONERS — For servo adjusters, range suppressors, or control point positioners for relay control circuits. 4-page folder No. 48 gives applications, descriptions, dimensions. ★Request on company letterhead, indicating your name and title. Automatic Temperature Control Co, Inc, 5500 Pulaski Ave, Philadelphia 44, Pa.

B10 BOILER WATER CONTROLS—Feeders, low-water cutoffs, pressure relief valves for boilers, heaters, pumps. Illustrations, capacities, service recommendations. 8-page small size circular No. S-185B. McDonnell & Miller, Inc, 3500 N Spaulding Ave, Chicago 14, Ill.

ELECTRICAL EQUIPMENT

B11 OIL SWITCHES—5000 v single-throw switches, rated 200, 400, and 600 amp, ball and groove high-pressure contacts give full-load break. 4-page bulletin No. DC51 has photos, dimensions. G & W Electric Specialty Co, 7700 Dante Ave, Chicago 19, Ill.

B12 MOTORS — 4-page bulletin No. MD-24 outlines line of motors, giving characteristics, ratings, applications. Single and polyphase, also multi-speed motors. Wagner Electric Corp, 6400 Plymouth Ave, St. Louis, Mo.

B13 ENCLOSED MOTORS—Fan cooled and non-ventilated types. Suitable for use where there is dust, dirt, dry ash, corrosive gas. 8-page folder No. 51B7225 shows construction, gives ratings and dimensions. Allis-Chalmers Mfg Co, 961 S 70th St, Milwaukee, Wis.

B14 ROTARY PACKET SWITCHES—Control electric circuits operating at 10 to 500 amp, 115 to 600 v ac, and up to 250 v dc. 12-page folder gives ratings, dimensions, mounting types. Appliance Control Div, Arrow-Hart & Hegeman Electric Co, Hartford 6, Conn.

B15 INDUCTION HEATING—12-page bulletin No. GEA-5879 describes forging, hardening, brazing, and annealing applications at 1000, 3000, and 10,000 cycles. Explains components and requirements, gives photos, ratings. General Electric Co, Schenectady 5, N. Y.

B16 SIGNALING DEVICES — Chimes, bells, buzzers, fluorescent lamp ballasts, push buttons. 8-page bulletin gives complete catalog information. Lee Electric Co, 182 Beckwith Ave, Paterson, N. J.

HEAT EXCHANGERS

B17 AERO HEAT EXCHANGER—4-page Bulletin No. 140 explains principles of operation, has cut-away diagram, installation photos. Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.

B18 TUBES AND PLATES—For condensers and heat exchangers. 44-page booklet No. B-1 discusses application and installation; for engineers responsible for selecting materials in marine, oil refining, and stationary steam plants. Tables of physical properties, microphotographs. American Brass Co, Waterbury 20, Conn.

MAINTENANCE AND SAFETY EQUIPMENT

B19 DIESEL ENGINE STAND—4-page folder describes construction and use. Photos, specifications. R & G Mfg Co, 504 Wysor Bldg, Muncie, Ind.

B20 WINDER-UPPER — For meters, instruments, clocks. 4-page bulletin illustrates 3 types. J A Campbell Co, 245 E Wardlow Rd, Long Beach 7, Calif.

B21 LATHE ACCESSORIES—16-page catalog No. 5102 gives complete information on collets, spindles, tool blocks, face plates, twist drills, etc. South Bend Lathe Works, 425 E Madison St, South Bend 22, Ind.

B22 SULFUR FIRES—Technical bulletin describing extinguishing techniques. 1-page bulletin No. 28. Ansul Chemical Co, Marinette, Wis.

B23 LUBRICATION — Specialized lubricants that cover majority of plant requirements with minimum of types and densities. Characteristics, uses, specifications. 20-page bulletin No. EK-15. Keystone Lubricating Co, 21st, Clearfield and Lippincott Sts, Philadelphia 32, Pa.

B24 OIL FILTERS—Portable *Purivac* system restores used insulating and transformer oils to new specifications. Two 4-page folders give case histories, illustrate operation. Homan-Crane Corp, 200 Superior, Lebanon, Ind.

MAINTENANCE MATERIALS

B25 RUBBER SHEET PACKINGS—4-page bulletin gives description, specifications, service recommendations, for gum, neoprene, red-rubber, oil-resistant packings. Raybestos-Manhattan, Inc, Packing Div, Manheim, Pa.

B26 CONCRETE REPAIR — Ready-mixed *Floorkote* is resistant to oil, grease, acids, moisture. 2-page bulletin No. L-451. Paramount Industrial Products Co, University Center Station, Cleveland 6, Ohio.

★ REFRACTORY COATING — *Corr-Kote* protects against slag penetration, abrasive wear, flame erosion, thermal shock. 4-page bulletin. ★Write direct on company letterhead to Williston & Co, Delta, Ohio.

B27 SURFACE PROTECTION — Coatings expand and contract like the materials they protect. 12-page bulletin gives data on development and application of *White-Set* and *Pyro-Chrome* coatings. Preferred Utilities Mfg Corp, 1440 Broadway, New York 18, N. Y.

B28 PAINT ANCHORING—Corrosion-resistant phosphate treatment for metals. 8-page booklet gives common causes of paint failure and how they can be prevented. *Anchorite 100* process is discussed. Octagon Process, Inc, 15 Bank St, Staten Island 1, N. Y.

MATERIALS HANDLING

B29 VIBRATORS—Air-cushioned unit eliminates noise. 4-page bulletin gives construction features, dimensions, photos. Cleveland Vibrator Co, 2828 Clinton Ave, Cleveland 13, Ohio.

B30 COAL- AND ASH-HANDLING EQUIPMENT—For power plants. 44-page book No. 2410 has layout drawings, photos of large and small installations. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

B31 ASH HANDLING — Pneumatic systems. 4-page folder shows installation photos. Allen-Sherman-Hoff Co, 250 E Lancaster Ave, Wynnewood, Pa.

B32 BELT CONVEYOR CARRIERS—12-page bulletin No. 3-C gives complete catalog information. Light- and heavy-duty carriers, belt-training

(Continued on page 205)

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STEAM GENERATORS

Happy New Year!

AN ENGINEER FRIEND left his plant during the war to teach steam-plant operation in a trade school. "It's no use," complained his predecessor. "I've been trying to get supplies, but the Board of Education won't give me anything." The new instructor looked around the shop. Pumps, engines, etc, were scattered about. Tools were kept in boxes. Some students were reading comics, others horsing around.

"Have patience," the principal advised. "It takes the Board time to allocate money." But my friend pitched in by designing a tool crib with his class. He sent some boys to a nearby building being wrecked. Old lumber and heavy wire screening made a dandy tool crib.

"Let's build foundations under the machines and bolt them down," suggested a student, getting interested. My friend passed his hat and collected enough small change for cement. "Let's build a grating and hand rails around the vertical steam engine's cylinders," said the instructor, "then all of us can assemble up there for setting valves."

A junky's son and two classmates brought six pieces of 3-in. angle iron, 8 ft long, by street car. (The conductor finally gave in.)

After three months, the shop had a central tool crib with a tool board. The steam engine with its ladder and large grating earned its keep. All auxiliary machinery was regrouped, with students assigned to each machine.

And everything needing paint had a fresh coat—paint was "borrowed" by students from home. Average monthly class attendance shot up from 51 to a high of 93%.

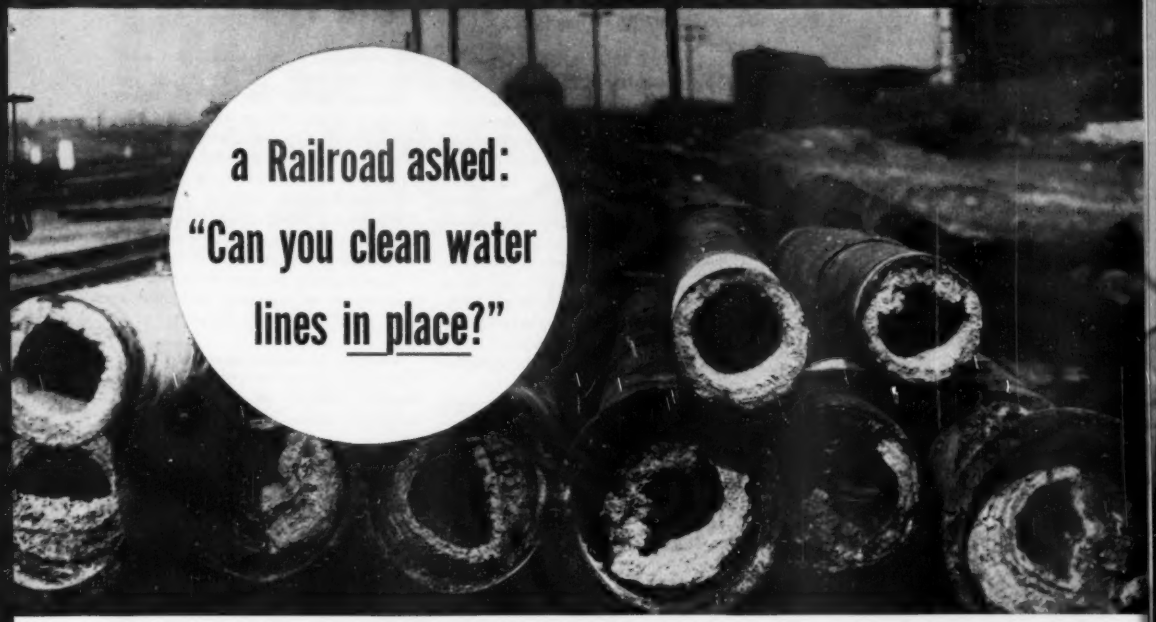
Are you waiting for a handout in 1952? America was built by initiative. For a Happy New Year, let's take a good swig of this potent medicine.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service cleaned over 8600 feet of buried water line in six days!

You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service cleaned all the lines, *in place*, in only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective cleaning of pipelines—underground or above, indoors or out. No digging or dismantling is necessary. Dowell liquid solvents, designed to dissolve the accumulated deposits, are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water flow, cleaning places inaccessible to other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job, using Dowell-designed, truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned efficiently, economically by Dowell Service. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let *Dowell Service save you time and money* in maintenance cleaning!

Other recent Dowell jobs:

Water well cleaned for large utility. Original production of 1150 gpm had dropped to 550 gpm. Dowell Service brought production back to 1100 gpm.

★

Boiler cleaned for steel company. Steam production before Dowell Service: 115,000 p.p.h.; steam production after Dowell Service: 145,000 p.p.h.

★

Air cooling system on two 22,500 K.W. generators cleaned for Midwestern Utility company in four hours. Before Dowell Service, the operating temperature of the generator was at the maximum allowable of 60° C. After service, the temperature was a normal 50° C.

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★ *Chemical services for oil, gas and water wells.*
★ *Magnesium anodes for corrosion control.*

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More TECHNICAL BRIEFS

Begins on page 150

in application of rectifier drives. *AISE paper. No number.*

Modern Ac-Dc Crane Control for Steel Plants. *By W R Wickerham and G E Mathias, Westinghouse Electric Corp.*

Load - o - matic alternating - current crane-hoist control system is development of the reactor system. In the new system, motor torque has been arranged to respond principally to load on the hook, rather than to speed. Load-signal generator or *load detector*, is an inductor actuated by an eccentric bearing supporting hoist-rope equalizer sheave. Mechanical deflection resulting from hook load is converted into a proportional electrical signal, which excites reactor to coordinate motor torque with load.

System employs unbalanced voltage to modulate motor torque, as do two other systems in extensive use. Unbalance, however, is variable, and reduces with increase in load through action of load detector. Reduction of unbalance estimates excessive motor-input currents ordinarily associated with this type of control.

Reduced light-hook hoisting and lowering speed is controllable between limits of 20 to 60% normal. Load detector may be adjusted to produce any desired full-load lowering speed. This provides speed-torque characteristics heretofore unattainable with any type control. Speed may be arranged to decrease with load; it is proposed that speed on first lowering controller point shall decrease from light-hook value of 20 to perhaps 5% at rated load.

Optional features provide that lowering speed for any load may be slowed to standstill and the load "floated." Incremental hook movements averaging 0.03 in. have been consistently attained on crane having normal hook speed of 40 fpm. Limit contacts on detector can be arranged to operate an overload signal, or to prevent crane from lifting a dangerous overload. *AISE paper. No number.*

Ignition Delay in Oil Burners. *By Ferdinand Hamburger, Jr, Johns Hopkins University.*

During the fall of 1949 an oil-burner installation in an apartment house development failed to give satisfactory performance. "Puffs" of considerable magnitude occurred in 8 of 14 burner locations, with repetition of this difficulty as many as 6 times for a single burner. The gun-type domestic oil burners consumed from 5 to 15 gal of oil per hr. Difficulty was traced to ignition delay, and this paper reports a test program to investigate the time delay between application of voltage to the ignition-transformer primary and initiation of spark discharge in the spark gap. The direction to be taken in further investigation of the delay phenomenon is indicated.

A standard domestic oil burner, without oil and with commercial nichrome electrodes of 1/8-in. dia adjusted for a 1/8-in. spacing, was used in all tests. Burner's power supply was arranged so starting the blower motor had no effect upon voltage supplied to the ignition transformer primary.

A special timer automatically cycled the oil burner for any desired on-off period, and simultaneously controlled a 2-pen brush oscillograph to measure the delay. One pen recorded the instant of voltage application to the ignition transformer primary; the second recorded the incidence of spark discharge. The time difference between start of the traces of the two pens gave the time-delay. *AIEE paper No. 51-320.*

Lubrication

Standardization in the Lubrication Department. *By J D Lykins, Wheeling Steel Corp.*

The AISE has set up committees to study standards for dc mill motors, machine surface finishes, crane wire and many other units. Standardization is of prime importance to steel industry.

Wheeling Steel Corp realized value of standardization in lubrication shortly after this department was established in 1939. First concern was standardization of lubricants in all plants. One plant or department often had two or three similar products for lubricating similar equipment. Since the program for standardization was started, the number of products used has been reduced about 75%. In one plant alone, 147 products were used in 1940. Now there are 24.

Lubrication engineer is also concerned with standardization of equipment like grease fittings, oil cups, centralized lubricating systems, pumps, valves, sprays, seals, bearings, etc.

In one plant three types of oil cups were used. One cup had to be filled every four hours. Another cup had capacity for 12 hours. By standardizing on the larger one, the oiler could fill cups every eight instead of every four hours with ample oil for safety. With 300 cups, the oiler was assigned additional equipment.

Standardization affects: (1) inventories—reduces storage space and size of inventory (2) purchasing—permits buying to specifications and in larger quantities, effecting saving in unit costs (3) simplification—reduces chance of using wrong product (4) turnover—faster turnover reduces chances of deterioration in storage and (5) training—eases training of new personnel for maintenance of equipment and lubrication. *AISE paper. No number.*

Directions for ordering papers on p 152

Quality Control of Lubricants. *By Carlyle R Burton, Oliver Iron Mining Co.*

Mining iron ore requires variety of heavy-duty equipment, which offers many complicated lubrication problems. To insure proper lubrication of equipment, a preventive-maintenance program is carried on. Quality control of lubricants is part of this program and consists of analysis of new fuels and of new and used lubricating oils, greases, water, etc. By its analysis, the oil laboratory keeps to a minimum the number of lubricating products required and controls lubrication of some 265 odd pieces of engine-powered mining equipment.

By simplified analysis the oil laboratory tests over 100 samples per day, determining whether any oils need renewing or filtering. Check on oil viscosity and percent solids in the oil determines action of oil shop laboratory.

Quality control of lubricants allows volume purchasing savings, decreased lubricating-oil consumption, decreased engine wear and increased mine production due to less equipment downtime. *AISE paper. No number.*

Reconditioning Air Filter Oils. *By George Findlay, Republic Steel Corp.*

Use of filtered air in steel industry has been confined more or less to cooling large critical motors, motor-generator sets and motor rooms.

However, there is considerable thought and study about preventive maintenance to cut delay and downtime of prime movers like turboblowers.

Where periodic impeller replacement or repair intervals can be extended appreciably, savings will quickly amortize investment in filtering equipment. Savings include reduction in abrasive

(*Continued on page* 184)

CHAPMAN

Steel Valves Score on all 3 Points

1

CHAPMAN STEEL VALVES have the high precision ratings of custom-made valves — but the economy of production-line manufacture.

2

CHAPMAN STEEL VALVES are made exclusively from quality-controlled steels developed and produced in Chapman's own foundries under control of Chapman's own outstanding metallurgists.

3

CHAPMAN STEEL VALVES are designed to equal or surpass — A.S.A. and A.P.I. Standards in all pressures and temperature ranges.

Be sure to see Chapman first whenever you need steel valves — gate, globe, angle or check. As a result of Chapman's long years of research and experience, they are tops in every respect.

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INDIAN ORCHARD, MASS.

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CHECK THESE DESIRABLE FEATURES:

- Bolted bonnet construction
- Heat-treated and hard chrome plated stainless steel wedge
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- Tongue and groove bonnet joint

It's well designed. It's low priced in its field.
See your R-P & C distributor or write nearest R-P & C district office.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

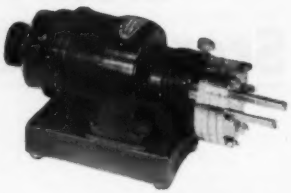
"Intentionally Better"
READING-PRATT & CADY VALVES

More EQUIPMENT NEWS

Begins on page 154

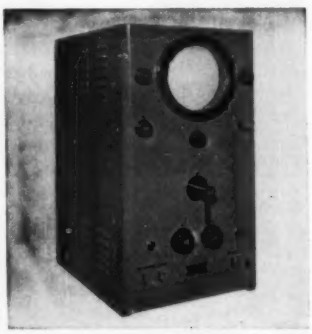
bin seals in the air so chemical's power is not dissipated.
Nox-Rust Chemical Corp, 2425 S Halsted St, Chicago, Ill.

For more data on these items, use post cards, p 163. Identify request with P and number.



SMALL METERING PUMPS P129

Of fixed and variable capacity for dispensing controlled volumes of hot or cold viscous or non-viscous liquids, these pumps handle oils, soaps, fats, grease, wax, glue, plasma, vaccines, serum, soft drinks and coffee. Governor-controlled units provide full power at all speeds from 10 to 750 rpm. Variable-speed, transmission units are adjustable for capacities of 0 to 50 ml per second. Liquid is dispensed as soon as motor starts; a check valve prevents dripping when motor stops. Maximum head pressure is 15 psi. Pump heads are quickly demountable and sterilizable.
Mechanical Products Corp, 168 N Odgen Ave, Chicago 7, Ill.

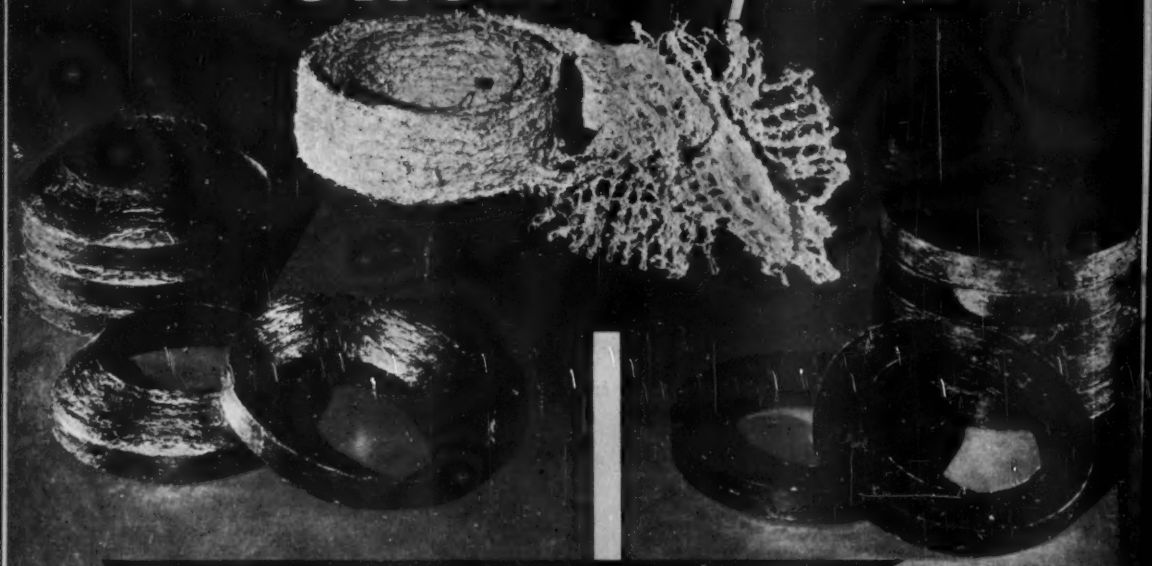


INSULATION TESTER P105

Redesign of 10-kv winding tester, for detecting insulation faults and winding dissymmetries in motors, generators, and coils. Particularly effective in production-line testing because tests can be made easily and quickly. Tester detects insulation faults by stressing turn-to-turn and coil-to-coil insulation to higher values more conveniently than other methods.

Consists of a repeating-type surge voltage generator, a cathode-ray oscillograph, and a synchronously driven switch for alternately reversing direction of surge travel through the winding. Entire tester is con-

ANCHOR VY/FLEX



. . . A Flexible Metallic Packing That Withstands HIGH Pressures . . . and HIGH Temperatures . . .

MODERN power-operated machines have created a demand for packings capable of giving service on greater pressures and temperatures than ever encountered. To meet such a need comes Anchor VY/FLEX, a highly specialized packing designed by The Anchor Packing Company to withstand the operating elements where many other packings have failed. VY/FLEX withstands most high pressures and high temperatures . . . is adaptable to a wide variety of uses. Write us today for full details.

RECOMMENDED FOR:

- POWER PLANTS AND STEEL MILLS
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- CHEMICAL PLANTS
- IN THROTTLE VALVES, REDUCING VALVES, HOT BLAST VALVES
- WATER COLUMN GASKETS
- TAR
- ASPHALT AND ACID PUMPS
- HIGH TEMPERATURE GASES
- AIR COMPRESSORS
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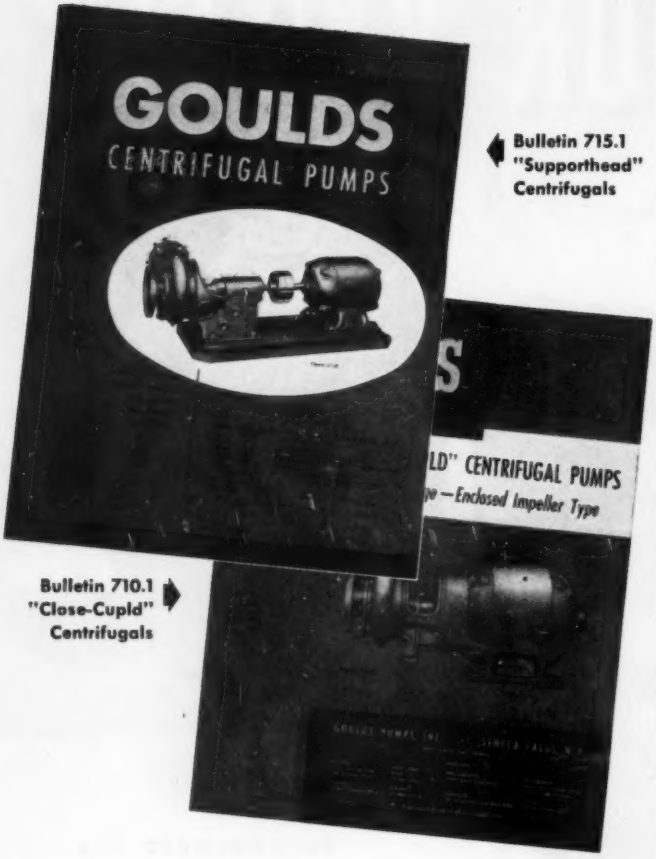

These new bulletins make it easier for you to select the right pump

These new bulletins have been designed to help you. New sizes are listed, and, in each bulletin we have put a composite rating chart which includes both "Close-Cupld" and the supporthead. This makes it dead simple to put your finger on the right pump for your requirements.

Another valuable feature of these bulletins is the parts chart. Using this you see exactly what parts are interchangeable for all size pumps and so can keep your spare parts investment to a minimum.

Use the coupon below to send for these useful FREE bulletins *today*. Goulds Pumps, Inc., Seneca Falls, N. Y.

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More EQUIPMENT NEWS

Begins on page 154

tained in one cabinet. Unit has surge generator capacitance of .05 mf, voltage of 0.2 to 10 kv (adjustable in 2% steps), and current capacity of 100 amp. Gives adequate coil-to-coil and turn-to-turn test to motors as large as 2000-hp, 2300-v. May also be applied to miscellaneous small- and medium-sized coils and dc armatures up to 20-hp, 220-v.

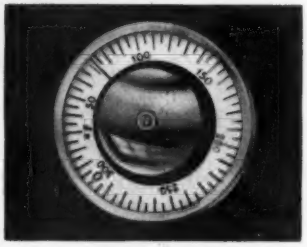
General Electric Co, Schenectady 5, N.Y.

For more data on these items, use post cards, p163. Identify request with P and number.

AIR DIFFUSER P122

Adjustable, double-flanged conical air diffuser, the *Flexiflo*, has equalizing deflector that is an integral part of the equipment. Effective diffuser area can be varied from zero to full volume, give changes in air throw yet not change its diffusion pattern. The unit, available in 11 sizes, can supply as high as 9000 cfm with a throw over 48 ft.

Universal Diffuser Corp, 890 Whittier St, New York 59, N.Y.



SURFACE THERMOMETER P124

A small amount of silicone grease lets you apply this 0-300 F, 2-in. dia model 310 surface theremometer to refrigerators, cold chambers, journals, motors, industrial walls for temperature readings or checking on heat and cold leaks.

Pacific Transducer Co, 11921 W Pico Blvd, Los Angeles 64, Calif.

HIGH TEMPERATURE COATINGS P120

Longer life for ceramics, refractories, metals working in high combustion gas atmospheres depends on protecting them against penetration and destruction of their surfaces by hot corrosive gas. *White-ho*

WORLD'S BIGGEST DIESEL...

You ride an elevator or climb three flights of stairs to reach the top of this giant engine. It's the world's biggest Diesel, built by Burmeister and Wain for the H. C. Orsted Central Electricity Works, Copenhagen, Denmark. The engine is 38 ft. high and 80 ft. long with generator and exciter. It has eight cylinders (33" bore, 59" stroke) . . . is rated at 22,500 h.p. . . . produces 15,000 kw.
To protect those mammoth cylinders and pistons, the operator chose a famous Gargoyle Diesel lubricating oil. This same kind of Correct Lubrication is available for your power, production, and other plant machinery... to assure maximum output, lowest possible upkeep costs. Just call your Socony-Vacuum Representative.

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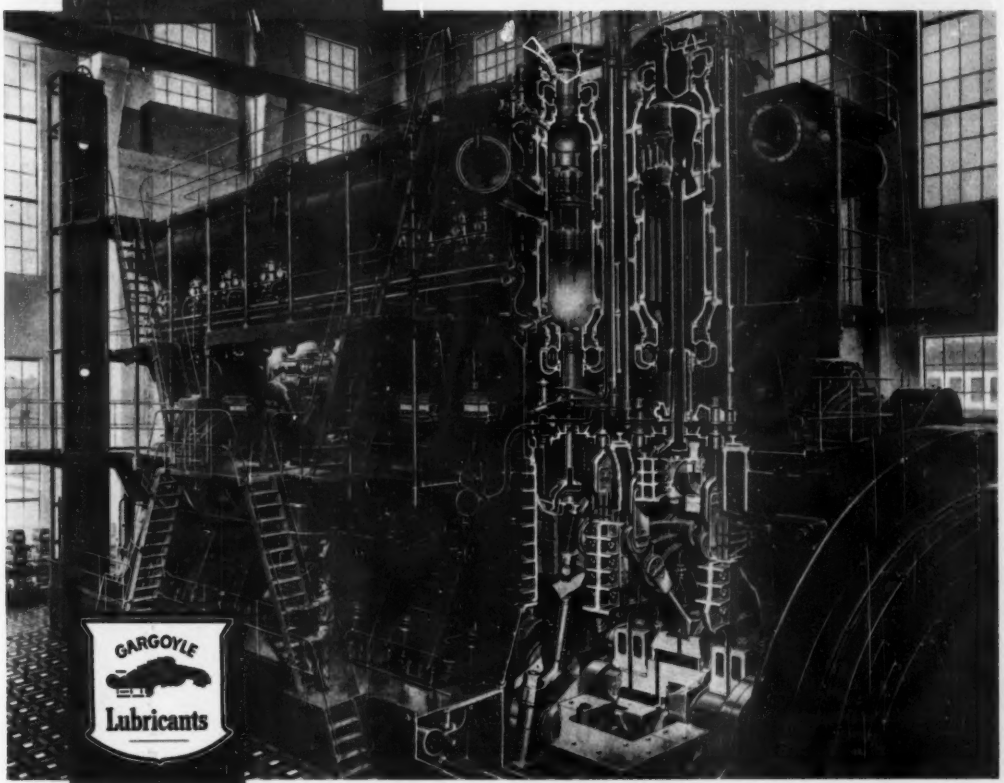

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SOCONY-VACUUM *Correct Lubrication*

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for temperatures up to 2840 F or *Pyrochrome* up to 4000, paints applied to the surface are said to resist this action. Further they are said not to peel, crack or blister and to expand and contract like the material they cover.
Preferred Utilities Mfg Corp, 1860 Broadway, New York 23, N.Y.

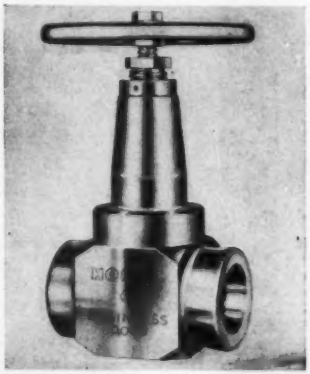
For more data on these items, use post cards, p 163. Identify request with P and number.

ELECTRICAL SHUNTS **P106**

Three sizes, MSA, MSB & MSC cover ranges from 30 to 1200 amp. Shunts are mounted on bakelite blocks for insulation to 1500 v; suitable for use with all types and makes of 50 mv meters.
Assembly Products Inc, Mail at Bell St, Chagrin Falls, Ohio

SEALING COMPOUNDS **P113**

Compounds designed for high electrical insulation and low moisture transmission. *Permo Potting* and *Sealing Compounds* have high electrical resistance and retention of viscosity over wide temperature range. Suitable for casting and sealing of electronic parts, batteries, transformers, coils, condensers.
H V Hardman Co, Inc, 571 Cortlandt St, Belleville, N.J.



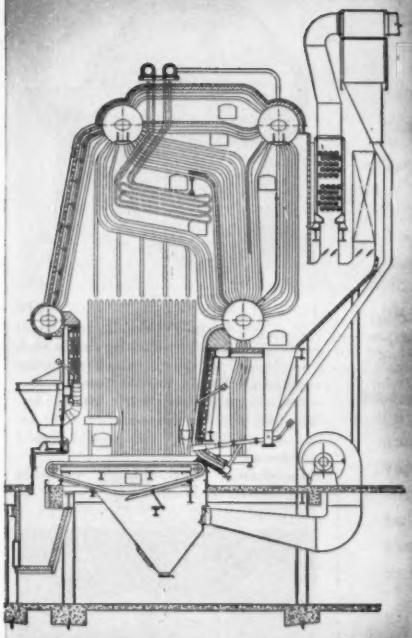
GLOBE VALVE **P136**

Furnished in sizes from ⅛ to 6 in., inclusive, these valves may be horizontal or angle type made of various stainless steels. Type 302, 304, 321 and 347 stainless steels can be used for bodies. Stems and disk are made of a new stainless steel, No. 322. These valves are said to reduce size and weight 75 to 85% over cast-steel valves. Parts are machined and welded together,

UNION

STEAM GENERATORS AT BURROUGHS . . .

33 Years
of UNION Service



Burroughs Adding Machine Co.
Have Used UNION Boilers Since 1917

33 years ago The Burroughs Adding Machine Company installed their first Union Boiler. Periodically since 1917 they have added more Union installations. The latest Union "N" Type boiler equipped with Detroit Stoker is operating in the Detroit Burroughs plant.

The history of Union Boilers in constantly expanding business organizations the country over is similar to the Burroughs story.

Obviously the product gives satisfaction.

You will do well to select Union Boilers because Union's 60 years of engineering and manufacturing experience goes to work for you in an installation which fulfills your requirement perfectly.

Consult with our engineers . . . you can depend on Union to serve you well.

UNION IRON WORKS . . . *Since 1890*

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BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

Treat Cooling Water *with Chlorine* — the Proven Way

HELP MAINTAIN MAXIMUM PLANT EFFICIENCY...

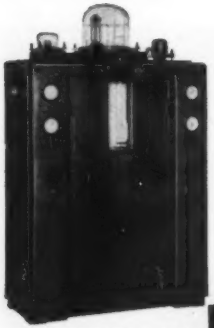
Hundreds of power plants and refineries have found chlorination by W&T the answer to heat exchanger slime problems. By eliminating slime forming microorganisms, maximum heat transfer is maintained in the condensers. The result — overall plant efficiency is kept at a maximum.

REDUCE LABOR COSTS...

High labor costs involved in frequent condenser tube cleaning are eliminated when chlorination is employed. Man-hours used for tube cleaning can be utilized for other maintenance jobs, an important factor with the increasing manpower shortage.

REDUCE DOWN TIME...

Elimination of frequent shut-down for tube cleaning helps power plants stay continuously "on the line." When chlorination is employed, many plants find that outage for cleaning is reduced to once per year and then only for removing trash from tube sheets.



W & T Air Operated Visible Vacuum Chlorinator

Years of operation have proved the dependability and accuracy of W&T Chlorinators for cooling water treatment. Low maintenance and automatic program operation keep operating costs to a minimum. For information on how you can solve your slime problems, contact your nearest W&T Representative or write to:

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WALLACE & TIERNAN PRODUCTS, INC.

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Begins on page 154

eliminating packing bolts. Internal polishing helps prevent corrosion. Furnished with either bolted or welded caps, screwed, flanged or socket-weld ends. Welded closed, the valves are especially good for handling poison liquids and gases, and in atomic power plants. Class 10,000 lb.
Hoppe Engrg Co, Inc, Greensboro, Ind.

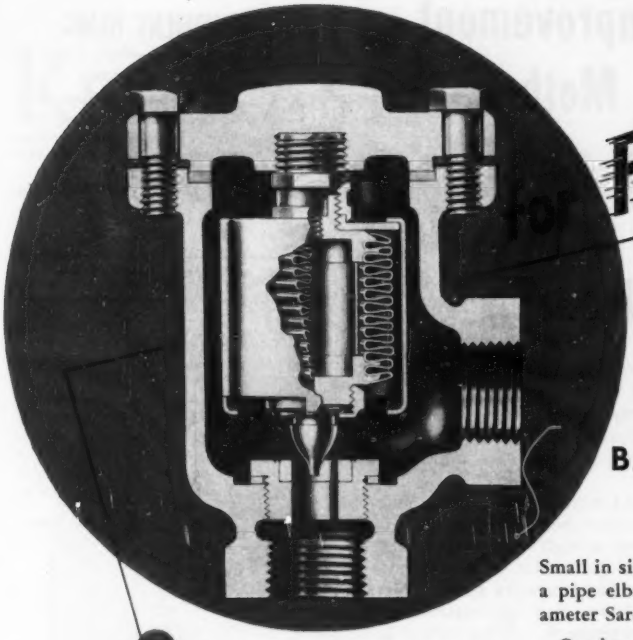
For more data on these items, use post cards, p163. Identity request with P and number.

TEST STANDS **P116**

Specially designed hydraulic test stands for flexible aircraft hose testing can be readily adapted to valves, cylinders, similar equipment. Stands include pumps, relief valves, oil reservoirs, electric motors, flexible couplings for pressures to 5000 psi and up to 30,000 psi with special booster equipment.
Superdraulic Corp, 14265 Wyoming Ave, Detroit 4, Mich.

DIESEL-ENGINE STAND **P137**

All-Kleer diesel-engine stand holds cylinder heads from the sides, does not block cleaning or other work on the manifold ends. Four adjustable engaging pins grasp head firmly in a non-jiggling grip. Pins fit into head bolt holes and lock into place. Small and compact, this stand handles heads and accessories up to 800 lb. It can



Sarco Thermostatic Steam Trap No. 9, available in sizes ½" to 2" for pressures to 300 psi. Bellows are phosphor bronze, monel or stainless steel as required, shielded from abrasion. Renewable valve heads and seats are of stainless steel.

FAST ACTION

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BALANCED PRESSURE THERMOSTATIC STEAM TRAPS

Small in size; light in weight, as easy to install as a pipe elbow, these new traps employ large diameter Sarco bellows proportioned to trap size.

Condensate only a few degrees below steam temperature snaps the large valve wide open. That means rapid and complete venting of air and non-condensables.

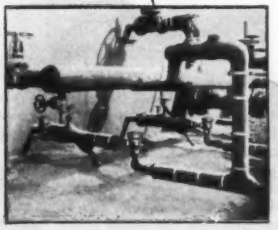
It means also exceptionally large condensate capacities.

Actually the balanced pressure type thermostatic trap has the highest discharge capacity per dollar cost.

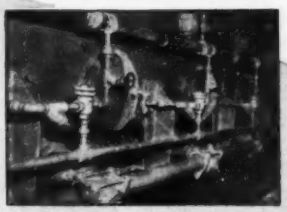
Other advantages: no seats to change when pressures change (fewer spares to carry); requires no protection against freezing.

WRITE for free copy of new catalog 256

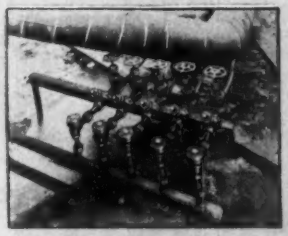
355



Sarco No. 9-225 traps and strainers draining steam heating coils in crude oil storage tanks.



Sarco No. 9-125 traps and strainers on bottle washer in brewery.



Sarco No. 9-300 traps and strainers removing air and condensate from steam tracer lines maintaining asphalt to storage tanks at pumping temperature.

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

SARCO CANADA LTD., TORONTO 5, ONTARIO

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With This NEW Improvement Niagara "No-Frost Method" puts you a big step ahead in trouble-free, automatic refrigeration or freezing

Niagara "No-Frost Method" keeps frost and ice COMPLETELY OUT of your cooling, chilling, freezing or cold storage.

It uses Niagara No-Frost Liquid Spray to keep frost and ice from ever forming. It gives you, automatically, refrigeration with no defrosting, and full capacity NEVER cut down by ice building up progressively on refrigeration coils.

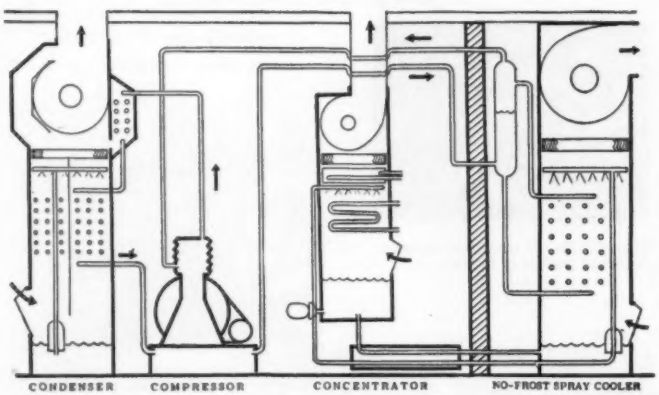
Now, a NEW design No-Frost Liquid concentrator, using a new principle, takes away moisture as fast as it is condensed by evaporating it at low temperature—not boiling it away at high temperature. It has 14 times the capacity of the old method per dollar of investment—one concentrator will handle a battery of high capacity spray coolers.

This gives you more refrigeration at lower cost; less machinery in less space. You operate at high suction pressure, saving power and wear and tear on compressors.

The extra capacity and lower cost both for equipment and operating makes this method advantageous for every type of refrigeration use—both for freezing and for moderate temperatures—for large "live" loads as in meat chilling or in fruit and vegetable pre-cooling—for rooms that are filled and emptied of product daily, such as milk rooms and terminal storage warehouses.

You get true trouble-free refrigeration . . . No brine . . . no salt solution . . . no dirt . . . no mess . . . It is entirely clean; you get rid of dirt and odors. You reduce both equipment and operating costs.

For complete information write to the Niagara Blower Company, Dept. P, 405 Lexington Avenue, New York 17, New York.



A simple method, easily maintained. Saves a third of your refrigeration cost. Ask for Niagara Bulletins 118 and 119.

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Begins on page 154

handle nearly every make of diesel head. Loosening or tightening a pressure brake permits rotation of engine head to almost any angle for convenient and speedy servicing.

R & G Mfg Co, 504 Wysor Bldg, Muncie, Ind.

For more data on these items, use post cards, p 163. Identify request with P and number.

MOTOR WATCHMAN P108

NEMA size 0 and 1 manual motor starters with built-in indicating lights. Mounted in NEMA type I enclosures, and designated as class 10-100-SI and 10-100SOA.

An indicating light generally is used to show whether starter is ON or OFF, but it can be wired into circuit to indicate other conditions. Light can be provided for ac voltages from 110 to 600 volts.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

SUBMERSIBLE PUMP P135

Subette is a small submersible pump designed for small capacities at high heads from wells of 6 in. inside diameter or larger. Capacity ranges from 30 to 130 gpm at heads of 80 to 770 ft. Motors, available in sizes of 5, 7½, 10 and 15 hp, are 3-phase, 60-cps, 2-pole, 220/440-v and run at 3500 rpm. A 50-cps motor running at 2900 rpm is also available. All motors are oil-filled, mechanically-sealed and capable of operating completely submerged in water. Pump is suitable for a diversity of applications like industrial plants, refineries, dairies, canneries, municipalities and many others.

Byron Jackson Co, P O Box 2017 Terminal Annex, Los Angeles 54, Calif.

FUSED MOTOR STARTER P107

Combination across-the-line motor starter with fusible disconnect switch designated as class 11-204-N. Unit consists of a disconnect switch, main line fuse clips, and a *Life-Linestarter* mounted in a common enclosure.

Enclosures can be provided for general purpose NEMA type I, semi-dust-tight

KEY-KAST

alloy welding fittings . . .

. . . engineered for longer life

- Greater wall thickness throughout
- *Extra* thickness in critical areas

Give *your* piping system these advantages of KEY-KAST Alloy Steel Welding Fittings!

- Greater allowance against erosion and corrosion—with extra thickness at critical areas.
- Increased structural strength—with greater wall thickness throughout.
- Lower unit cost.
- Meet A.S.M.E., ASTM, ASA Codes.
- Bosses provided for tapped openings.
- Controlled quality . . . through rigid metallurgical control . . . produced . . . inspected . . . tested in *one* plant.

Produced in low . . . intermediate . . . and various stainless steels in all shapes, sizes and schedules.

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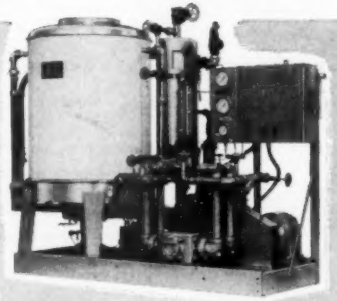
THERE ARE MORE *Clayton* FORCED RECIRCULATION STEAM GENERATORS IN USE THAN *ALL OTHER PACKAGE TYPE BOILERS COMBINED

*Self contained steam generators of from 15 to 100 horsepower



for the reason and proof of this statement mail the coupon

THIS COUPON BRINGS **PROOF** TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

P-1

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Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

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ADDRESS_____ STATE_____

CITY_____

Clayton

MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

More EQUIPMENT NEWS

Begins on page 154

NEMA type IA, dust-tight NEMA type V, or NEMA type XII to meet the JIC specifications of the mass-production industries. Available for 3-phase operation, up to 600-v, 60 cycles.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

For more data on these items, use post cards, p 163. Identify request with P and number.

OUTDOOR MOTOR CONTROL P109

Rain-tight outdoor motor control units designed for use on irrigation projects, are applicable to many other outdoor motor-control jobs. Consist of a combination across-the-line starter with circuit breaker in rain-tight enclosure, with built-in- *start-stop* pushbutton or *hand-off-auto* selector switch.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

LIQUID FILTER P115

Larger capacities permit new single unit, *synclinal* filters—in sizes of 75 gpm, 12½ in. overall by 6 in. dia; and 100 gpm, 14 in. overall by 1½ in. dia—to supply hydraulic and low pressure liquid recirculating machinery formerly requiring multiple filter installations. Units are available in line and sump types with mesh sizes from 30 to 200.

Synclinal filters have no movable parts, provide room for accumulation of foreign matter, allow longer operating periods between cleanings and have less down time for maintenance.
Marvel Engrg Co, 625 W Jackson Blvd, Chicago 6, Ill.

POWER'S History

POWER was founded in 1884 by E P Harris and H M Swetland. With it was incorporated *Steam*, which had been started by N Hawkins in Chicago two years earlier.

In 1903 POWER purchased and absorbed *Science and Industry*, which was a consolidation of a number of periodicals, namely, *Home Study Magazine*, *Home Study for Machinists*, *Mechanic's Magazine*, *Home Study for Building Trades*, *Building Trade's Magazine*, *Home Study for Electrical Workers* and *Steam Electric Magazine*.

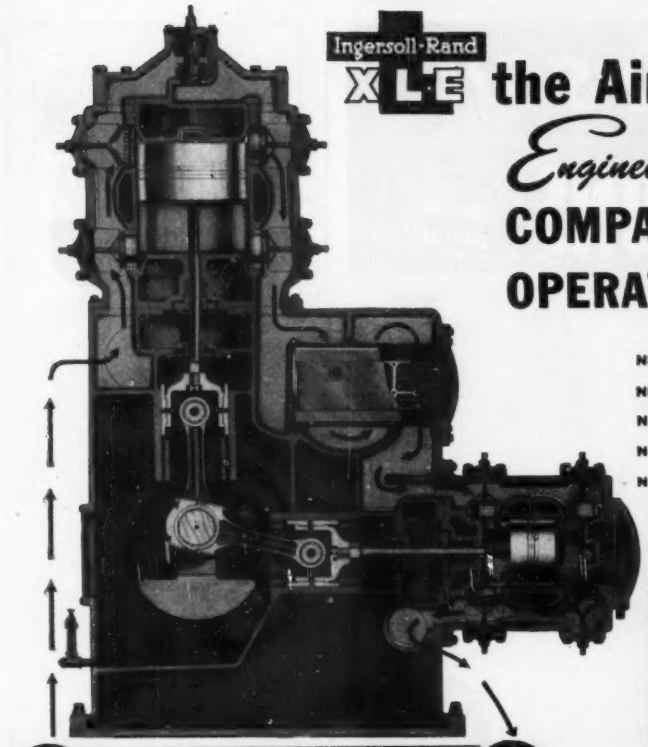
In 1908 POWER absorbed *The Engineer's Review*, of Cleveland, and *The Engineer*, of Chicago, the latter being a consolidation of *The Safety Valve*, *Lord's Power and Machinery Magazine*, *The Stationary Engineer*, *Steam Engineering* and *The Mechanical Engineer*. When *The Engineer* was purchased, the name of the combined magazine was *Power and the Engineer*. The title was condensed to POWER in 1911. All rights to the preceding titles reserved.

Ingersoll-Rand

XLE

the Air Compressor

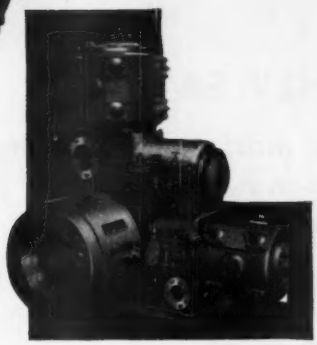
Engineered for COMPACTNESS AND OPERATING ECONOMY



PIPELESS THRU-FRAME AIR FLOW

Main air connections on the compressor frame eliminate piping strain from the cylinders. Air flow between these two points is entirely within the frame and cylinders. There is no interstage piping. The streamlined frame houses the intercooler and combined with the wide-flanged cylinders provides a sturdy construction that maintains alignment.

NEW *Air Flow* DESIGN
NEW *Intercooler* DESIGN
NEW *Cylinder* DESIGN
NEW *Frame and Running Gear* DESIGN
NEW L DESIGN



Packaged design for minimum floor space, and specially balanced for minimum foundation . . . ideal for skid-mounting.

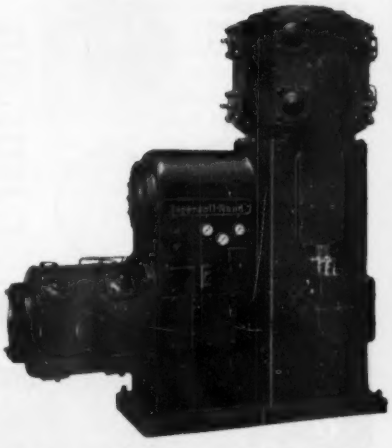
Easy to operate . . . push button starting, grouped controls, automatic force-feed lubrication, automatic condensate removal, automatic air-operated starting unloaders and capacity control.

Easy to install or relocate . . . ready-to-run, assembled shipment . . . simplified air and water piping.

Easy to maintain . . . simplified long-life construction . . . full-floating, cool-running, aluminum-alloy bearings that require no adjustment . . . no need to open the sealed crankcase which stays clean inside . . . streamlined exterior also easy to keep clean.

Low operating costs . . . new high-efficiency, long-life I-R Channel Valves result in compressor efficiency comparable to the largest units . . . durable, high-efficiency tube-and-fin intercooler saves water . . . efficient direct-connected motor.

Built for reliable, continuous full-load service . . . sizes 125, 150, 200, 250, 300, 350 horsepower . . . discharge pressures 80 to 125-psi, two stage . . . write for more information today.



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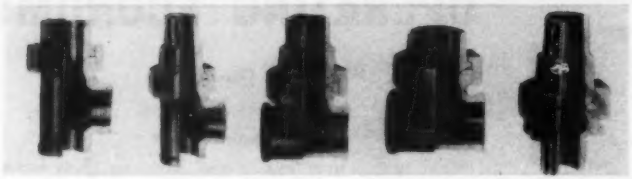
ROCK DRILLS • AIR & ELECTRIC TOOLS • OIL & GAS ENGINES • PUMPS • YURBO BLOWERS

Jefferson UNIONS

AIR-TESTED AIR-REFINED MALLEABLE IRON

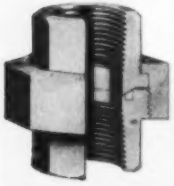
featuring the RECESSED BRASS SEAT



THEY SATISFY...

the most exacting demands

Whether it's a question of reducing the number of joints in a piping system, speeding up piping jobs, eliminating unnecessary maintenance or just getting all-round better service and performance, the answer is JEFFERSON UNIONS—the ones which provide the exclusive Recessed Brass Seat. This Jefferson feature means leak-proof tightness, leaves bore straight and unobstructed and provides a brass to iron spherical joint which makes up without undue pressure.



And bear this in mind—all parts of the Recessed Brass Seat are fitted and machined (not cast) with parts ground together to form a perfect spherical joint . . . a detail which has proved of outstanding merit in many years of hard service. Small wonder that "Jeffersons" satisfy.

In addition to the types shown, Jefferson makes AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All-iron seats can also be furnished in all types.

Your nearest distributor can supply you—or get in touch with us direct.

Jefferson UNION CO.

605 W. 26th ST., NEW YORK 1, N.Y.

63 Gooding St., Lockport, N.Y. 39 Fletcher Ave., Lexington 73, Mass.

My Biggest Boner

► MANY YEARS AGO I pulled a boner on a belt and the memory of it still hurts. A belt was loose on our 10-hp motor-driven exhaust fan. We'd used all the take-up on the motor, but the belt was still loose. Worse yet, oil had leaked from the fan bearing, coating the belt.

I saturated a rag with solvent to get the oil off belt. While rubbing the moving belt midway between pulleys my arm was dragged around the motor pulley. When it came out from under the belt I was thrown to the wall.

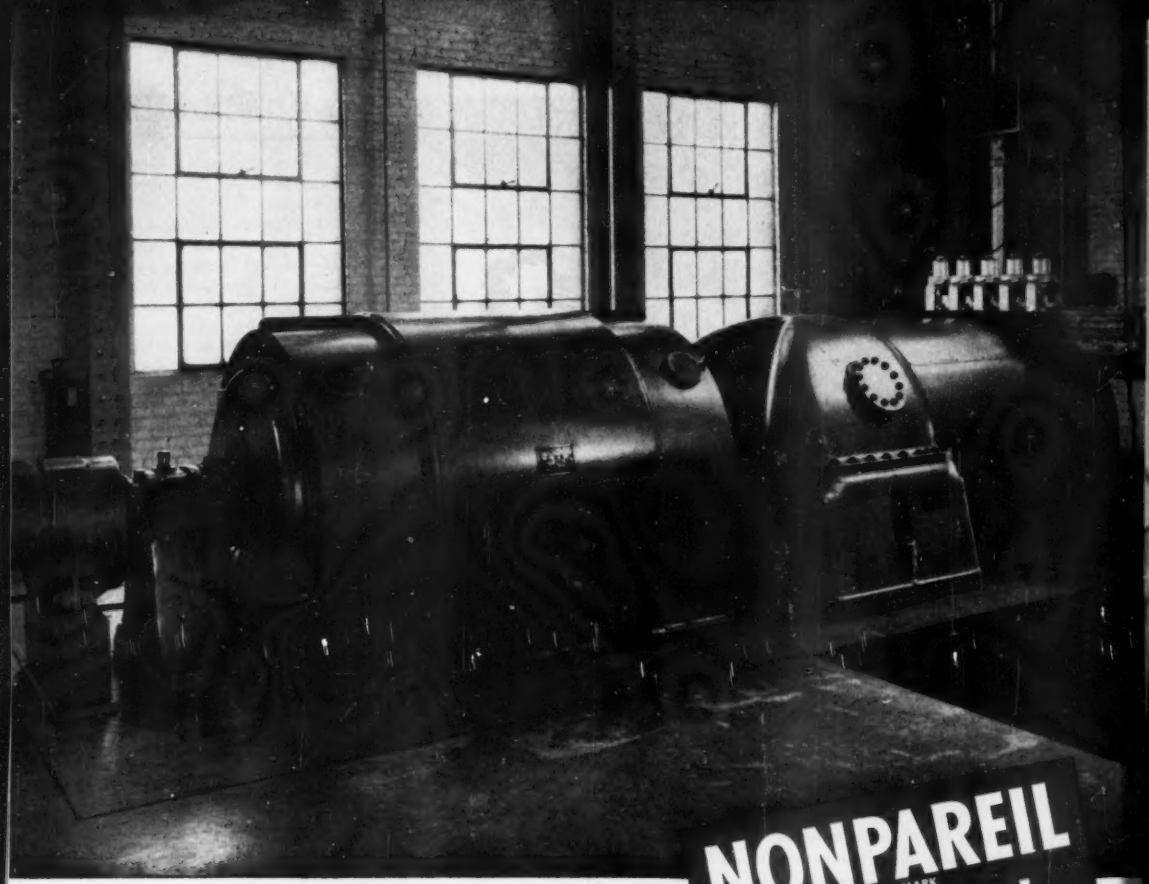
My arm wasn't hurt, luckily, but it was only because the belt was loose, not because I used my head.

What I should have done was stop the fan, replace the seal and clean the belt in a nice safe place like our shop. I've never cleaned a moving belt since then.

ALLAN ROKLIN *Chicago, Ill.*

● What is your "biggest boner"? We'll pay ten dollars for each one we publish.

Westinghouse Electric Corp is launching a $296,000,000 expansion program including a new plant in Raritan Township, N. J., for electronics equipment; a small motor plant at Union City, Ind., now more than half completed; electronic tube plants at Elmira and Bath, N. Y.; an aircraft-armament plant at Baltimore, Md.; a jet-engine-parts plant at Columbus, Ohio; an expanded plant for generator output at East Pittsburgh, Pa.; five new lamp plants; purchase of a plastics plant at Hampton, S. C.; and provision for substantial increases in production of household appliances and television sets.



NONPAREIL
TRADE MARK
Turbine Oil

12-year-old oil...good as new

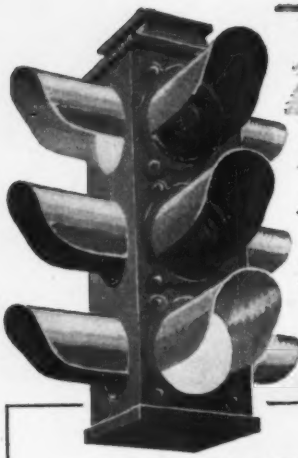
• When a midwest municipality placed this equipment in service back in 1939, NONPAREIL Turbine Oil made up the original fill. During this 12 years of service the acidity number has never exceeded 0.09 mg. KOH/gm. Low acidity has meant low turbine maintenance costs. Make-up requirements have remained at a minimum.

When a second turbine was installed in 1950, NONPAREIL's performance record left no question in the minds of plant operators concerning the selection of an oil. NONPAREIL again made up the original fill. As in every case, these plant operators received a written guarantee that NONPAREIL would last as long as the turbine itself—that it would never exceed an acidity of 0.15 mg. KOH/gm.

For your own turbine installation, new equipment or old, operating economy begins with the installation of NONPAREIL Turbine Oil. A Standard Oil lubrication specialist can show you records covering up to 23 years of continuous operation with NONPAREIL Turbine Oil, and he can show you how to put the advantages of NONPAREIL Turbine Oil to work in your own plant. Call your nearest Standard Oil Company office, or write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*

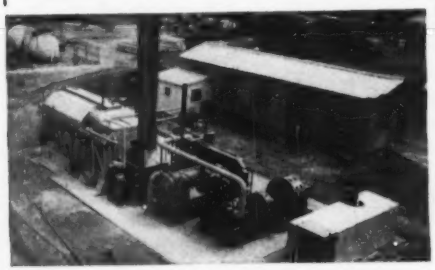


Packaged Boilers Deserve Good Fans, Too!

The same engineering talents and the same careful construction go into the many stack supporting draft fans we have designed for the so-called "packaged" boilers. In some ways, engineering faces more difficult design problems because of the utmost efficiency required in a relatively small space.

Green Stack Supporting Draft Fans are practical, too. They are readily accessible for inspection and maintenance. Shafts and wheels are removable endwise without disturbing the stack or other structural members.

To those manufacturing "packaged boilers" or to those operating them with fans that don't seem to be doing the proper kind of a job or where maintenance seems too high, we offer the services of our experienced fan engineers to (1) design fans suitable for the boiler or (2) study the problem and recommend the remedy.



Our New Bulletin 168 gives details of our Stack Supporting Draft Fans. Write for a copy.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More TECHNICAL BRIEFS

Begins on page 150

wear of impeller blading, lessening of downtime for repair and replacement of blading, etc.

Traveling-screen air filters predominate where blast-furnace blowing equipment is involved. Primary purpose of air filter is to remove solids that abrade the blading.

To be effective, air-filtering equipment must be maintained on continuous operating cycle. This demands installation of automatic, auxiliary oil-reconditioning system to maintain oil in screen reservoirs within acceptable limits of clarity. Changes to reservoir design would simplify installation and increase efficiency of oil-reconditioning unit.

This type of reconditioning maintains flashpoint characteristics of mineral oil used in air-filter reservoirs within limits of safe operation. After investigation of nonflammable fluids sometimes recommended for this service, it seemed advisable to accept possible fire hazard of mineral oil in preference to toxicity hazards of the others. *AISE paper. No number.*

Servomechanisms

Damper-Stabilized Instrument Servomechanisms. *By J Frank Koenig, University of Illinois.*

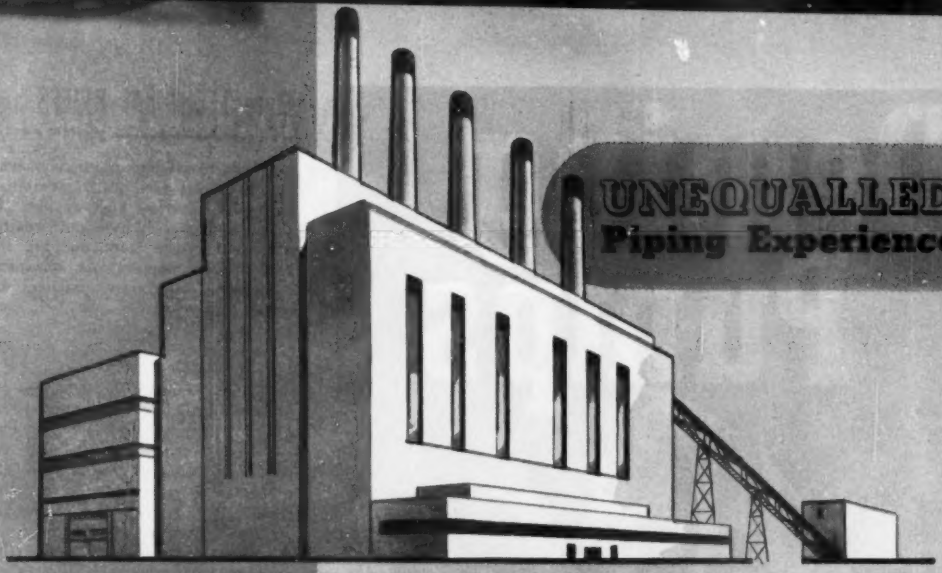
A new method of design for a viscous damper-stabilized instrument servomechanism is compared with the Nyquist diagram method. It is said to supply information not obtainable from the latter method. It gives the trajectories of the roots of the characteristic equation as two parameters varied simultaneously in any arbitrary manner. Because of this the new method can be called the root-trajectory method. It applies to equations or systems of all orders.

If the viscous friction varies during system operation as a function of temperature, then the diagrams give the trajectories of the roots as the viscous damping changes. Only two diagrams are required to obtain trajectories of the roots of any *n-th* order characteristic equation. *National Electronics Conference paper, available in Proceedings. J Armsey, Illinois Institute of Technology, 3300 S Federal St, Chicago, Ill.*

Directions for ordering papers on p 152

Practical Application of Servomechanisms. *By S P Higgins Jr. and G W McKnight, Minneapolis-Honeywell Regulator Co.*

Process control, since its inception,



UNEQUALLED
Piping Experience

Since 1945, Piping for More than

5,580,000 kw

of Central Station Capacity
scattered from Wicasset, Maine to Hawaii
from Grand Forks, North Dakota to Brownsville, Texas

has been fabricated and erected* by . . . MIDWEST

MIDWEST PIPING SERVICE IS NATION-WIDE

4 Plants Are Better Than 1

PIPING FABRICATORS AND CONTRACTORS

*Including Projects Now Under Construction or on Contract

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Pumps
Proper pump selection increases efficiency and reduces costs of operation and maintenance.
Proper pump selection demands FREEDOM of selection for type, size, capacity, head, and other factors.
Countless thousands of industrial pump specifications are met with "precision accuracy" by the great diversity of DEMING PUMPS.
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THE DEMING COMPANY
547 Broadway • Salem, Ohio, U.S.A.

More TECHNICAL BRIEFS

Begins on page 150

has been aimed toward most efficient use of process facilities to produce a uniform product of high quality. As processes and their associated control problems become more complex, the need becomes apparent for systematic analysis to supplement practical experience. The so-called servo-techniques seem to offer a powerful tool for expressing process control problems in terms of numbers.

This paper shows the usefulness of servo methods for predicting system behavior on an actual process. Previous papers have presented data derived from these methods on hypothetical processes and showed predicted results. But no data appear to be available in the literature showing test results on a physical system for comparative purposes. The paper also attempts to destroy the false impression that servo methods are necessarily highly mathematical and difficult to apply. *Instrument Society of America, paper No. 51-8-2. Available from ISA, 921 Ridge Ave, Pittsburgh, Pa.*

More POWER NEWS

Begins on page 148

ville and a 25-mile 11-foot dia tunnel from it to Rondout Reservoir near Lackawack, N. Y. Also under construction on the headwaters of Neversink River near Neversink, N. Y., is a dam and a 5-mile 10-ft dia pressure tunnel to divert that additional stored water to Rondout Reservoir. When these sources are tapped New York will enjoy a supplement of 540 million gal per day to its present Catskill and Croton sources.

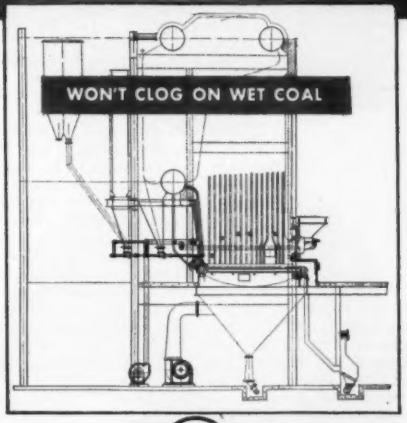
Before construction of the Delaware water supply, according to George R Rich, partner, Charles T Main, Inc, City of New York obtained the right to divert water from certain tributary streams upon which two private utilities, Central Hudson Gas & Electric Corp and Rockland Light & Power Co, had water power plants. Instead of money damages, the city and the two utilities entered into interesting agreements. These permitted each company to build a hydroelectric power plant at outlet of one of the two pressure tunnels. Water to operate the plants will be that normally consumed by the city. Revenue from sale of power will amortize damage sustained by the utility companies, and construction cost of power station and transmission line. In addition, the city will obtain a material revenue from sale of falling water. After 50 years the power stations will become city property.

Walker L Cisler
Detroit Edison Prexy

Cornell graduate (1922) Walker L Cisler, former Public Service Electric & Gas

TOP EFFICIENCY FROM LOW AND HIGH ASH COALS

PERFECT SPREAD STOKER



Three AE Perfect Spread 2-feeder, travelling grate Stokers recently installed by a leading pharmaceutical manufacturer in the midwest. The boilers, each with a maximum continuous capacity of 60,000 lbs. per hour are Union "A" Type. Efficiency at normal capacity, 83.4%; at maximum capacity, 82.4%. Consulting Engineer, Austin Company.

In the Boiler Room illustrated, the Perfect Spread Stokers were guaranteed to use coal containing either 13,306 B.T.U. or 11,327 B.T.U. per lb. as fired. These two coals have moisture contents of 4.7% and 10.7%, with ash content of 8.2% and 10.1%, respectively. With either coal, practically the same capacity is available but these Perfect Spread Stokers have done even better than predicted. Five different grades of coal have been used to date . . . and all with top efficiency.

Perfect Spread's unique feeder won't clog on wet coal but feeds uniformly—not in slugs—regardless of moisture content. Its engineered cinder return and adjustable overfire air system give comparable results from either low or high ash coals. Its even feed characteristic insures higher CO_2, freedom from smoke puffs, minimum carbon in the ashpit, and less fly ash. Feeders adjustable from 50 to 7,500 lbs. of coal per hour . . . capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon today for full data.

AE

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers

American Engineering Company
2400 Aramingo Ave., Philadelphia 25, Pa.

Gentlemen: We are interested in saving fuel dollars. Kindly send booklet giving full information about Perfect Spread Stokers.

Name ..... **Title** .....

Company .....

Address .....

City ..... **Zone** ..... **State** .....

GET THE
"Inside Story"
on Darts...see how
Better Construction
makes them a
Better Buy
6 Ways!
Nothing beats high-test air-refined malleable iron for resisting stress and stretching. That's what the Dart body and nut are made of.
These non-corroding bronze seats are the heart of a Dart! Special oscillating grinders give them a true bearing surface. The joint is absolutely leakproof!
Dart threads are full and clean-cut. Unlike threads of softer metal, they won't deform or strip.
Yes, Dart seats are wider. You get a drop-tight joint without violent wrenching.
This nut can take wrenching and does! It's extra heavy.
Darts are glad to work for you. You can use them over and over again and cut your costs.
DART
DART
UNION COMPANY
PROVIDENCE 5, RHODE ISLAND
THE FAIRBANKS CO. — Distributors
Boston • New York • Pittsburgh

More POWER NEWS

Begins on page 148

Co of N. J. operations specialist, government executive (Office of War Utilities), and army officer, has assumed the post of president of Detroit Edison Co.

For several years Cisler has been Detroit Edison's executive vice-president except while he served as power generation head for the Economic Cooperation Administration (ECA) under Paul Hoffman with headquarters in Washington, D. C. While with Edison he spent considerable time in revamping the company's organization and in developing personnel relations. For a long period he wrote a special feature on answers to employee's problems.

Swain Escorts European Executives

Throughout the week of Nov 25, Phil Swain, editor of POWER, escorted a group of top European industrial executives on a tour of American plants. The men in Swain's group (heavy electrical industry) included:

Dr Hans C Boden, vice-president Allgemeine Eletricitaets-Gesellschaft, Germany

Pierre Le Bourhis, president, Societe Alsthom, France

Henry P R Davezac, vice-president, Syndicate General de la Construction Electrique, France

Sir Vincent de Ferranti, Member of Commons, managing director, Ferranti Ltd, England

Thomas Furniss Lister, managing director, Hackbridge & Hewittic Electric Co, Ltd, England

Helge Ericson, president, Telefonaktiebolaget L M Ericsson, Sweden

Detroit plants visited included Ford Motor, Plymouth, Burroughs and Detroit Edison (Connors Creek). In and near Milwaukee the executives visited Allen Bradley, Globe Union, the Heil Co, and Wisconsin Electric Power Co (Port Washington station).

Later, in Washington and in New York, this team joined many similar groups visiting America under ECA auspices to discuss the application of American production methods in European countries to increase productivity, raise living standards, and build economic defenses against communism.

Coal Conversion Urged by Gas Assn

A great conversion-plant system could fortify and coordinate U.S. fuel supplies by using our immense coal reserves to produce uniform quality gas for peak-load requirements. This proposal was made by Frederic O Hess, retiring president of Gas Appliance Mfrs Assn at their 33rd annual convention in St. Louis.

He suggested a series of steps that would revolutionize the gas-distribution business and provide long-range benefits for both industrial and domestic gas users.

1. Construct large gas-conversion and standby plants at strategic points along the present natural-gas pipeline system and "near our huge coal reserves." These plants

Any Speed YOU NEED

WITH

GEARMOTOR

. . . because it is available in single, double or triple reductions, offering a range of speeds: 780 through 7.5 r.p.m. Motor rating from 1 h.p. through 60 h.p.—A-c or D-c. The motors and gear units are each self-contained and readily separated . . . gears in multi-reduction units may be inspected, without uncoupling from driven machine.

These small, compact, self-contained units simplify the direct application of electric drive to individual machines.

GearMotoR conforms to the recommended standards of the American Gear Manufacturers Association and the National Electrical Manufacturers Association.

Send for 42-page illustrated catalog, containing full information and data necessary for ordering, and please use your Business Letterhead when requesting same.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

ECONOMY

AT MODERATE INITIAL COST

100 TO 4000

HORSEPOWER RANGE

600# GA., 750° F.

STEAM PRESSURES

MURRAY

STEAM TURBINES

TYPE UV MULTISTAGE

The Type UV Multistage Turbine is available in from two to ten pressure stages making Multistage steam economy available at moderate initial cost. Horsepower range is from 100 to 4000, steam pressures up to 600# ga., 750° F., condensing or non-condensing. Several governors and accessories adapt UV Turbines to practically any mechanical drive within the capacity range.

Pictured is a 5 Stage UV Turbine developing 325 HP at 6200 RPM operating condensing. Turbine is equipped with variable speed oil relay governor, pressure lubrication and vacuum breaker, and is in use driving a centrifugal compressor for refrigeration.

Contact your Murray representative for prices and engineering information or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

More POWER NEWS

Begins on page 148

could make a gas containing hydrogen to be mixed with natural gas. This would augment supply, improve combustion performance, and produce a "really interchangeable standby gas" to perform uniformly throughout a large area.

2. Use the conversion plants to provide storage capacity for the interchangeable standby gas. Industry could then keep up with demand when natural-gas supplies were taxed by winter weather.

3. Use excess plant capacity to produce gasoline from coal, especially in summer when gas demand is lower and gasoline requirements are high.

4. Produce oil from coal—the product to be stored in concentrated raw form for winter-peak standby demands.

5. Use conversion plants to make hundreds of valuable chemical materials. When processed under controlled and mass-production conditions these would help defray cost of the over-all operation.

Nuclear Shielding A New Engineering Field

"Radioisotopes have been called the most useful research tool since invention of the microscope," H M Glenn, structural engineer of Oak Ridge National Laboratories, told the ASCE Structural Division at its annual convention. "The availability of radioisotopes is contributing more than any other factor today to the advancement of medicine and biology."

An engineer not directly involved in the atomic-energy program may be confronted with a problem involving shielding personnel against injurious effects of radiation from these isotopes. Both design and construction of hospitals and research centers using or studying radioisotopes will be modified by the need of shields. The radiations with which an engineer will be concerned are alpha and beta particles, gamma rays and neutrons," Glenn stated. Sufficient shielding to satisfy gamma radiation is more than ample to stop beta particles.

These radiations affect human tissue in a complex way. But Glenn pointed out that the largest part of the physiological effect is produced by fast, charged particles that destroy the delicate electrical balance between the atoms and molecules of human tissue. Gamma rays are very penetrative, and their damage to body cells is greater than X-rays.

Cells, barricades and other forms of personnel shields to stop or slow down destructive gamma radiations must be made of materials of high specific gravity like lead, steel and concrete. Concrete has been used extensively to protect man from overexposure to "hot" materials, especially where it can be made with heavy aggregates such as barytes, or steel pellets. For high-energy gamma radiation the relative thickness of various materials required is in direct ratio to their densities. Thus a 1-ft thickness of lead which weighs 708 lb per cu ft is equivalent to 1.5 ft of steel weighing 490 lb per cu ft; or to 4.9 ft of normal concrete weighing 145 lb per cu

(*Continued on page 222*)

CONTROL YOUR FEED

BUILD UP YOUR PROFITS . . . THIN OUT YOUR LOSSES

With Jeffrey-Traylor Feeders on the job the flow of coal (or other material) is under absolute control at all times. Photo shows two No. 5 J-T Feeders under track hoppers and feeding to Jeffrey Spiral Conveyor which takes coal to the various bunkers ready for use.

You virtually put your power plant on a strict diet . . . the feeders regulating the amount to be fed, exactly . . . just set 'em and forget 'em. J-T electric-vibrating Feeders are practically foolproof . . . nothing to wear out or lubricate. Power consumption is unusually low.

We build a type and size Feeder (desired capacity) to take care of your feeding requirements properly — tubular or pan decks, single or multiple power units. We also apply electric vibration to Conveyors, Screens, Dryers, Coolers and Packers. To be sure — better buy Jeffrey.

PARTIAL LIST OF WHAT WE MAKE

BIN VALVES • BUCKET ELEVATORS • CHAINS • COOLERS • CONVEYORS • CRUSHERS • DRYERS • IDLERS (BELT) • FEEDERS
PULVERIZERS • WEIGH FEEDERS • PACKERS • SCREENS • CAR PULLERS • SPROCKETS • TRANSMISSION MACHINERY

Literature On Request

JEFFREY

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

These Stickle Valves provide close-limit, chatter-free pressure regulation for liquid, air and steam

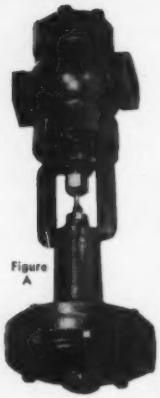


Figure A

Sensitive, accurate Stickle Valves will meet your most exacting requirements in automatic, positive pressure regulation... especially where pressures must be closely controlled within fractional variations. And they operate without vibrating or chattering, even when working close to seat.

Stickle Valves are available in two series — single-seated, balanced, Series 400 (Figure A) and double-seated, semi-balanced, Series 200 (Figure B). Series 400 Valves are spring- or lever weight-loaded, diaphragm-operated—built to regulate medium and high pressures and for dead-end service.

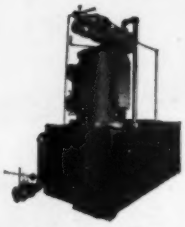
Figure B

Series 200 Valves are available in self-contained lever and weight types and pilot-operated construction. Also include Float Valves and Back Pressure Relief Valves. Once in service, they maintain pressures within variations of one-half of 1%.

All Stickle Valves have long service life—may be maintained easily right on the line. Get the full facts—*free*. Send for Stickle Bulletins 235 and 435—today.

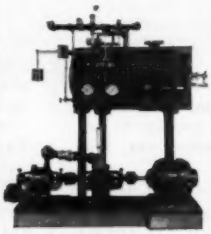
STICKLE STEAM SPECIALTIES COMPANY
2265 Valley Avenue, Indianapolis 18, Indiana

other cost-cutting STICKLE equipment



Stickle Open Coil Feed Water Heaters

Stickle Open Float Steam Traps



Stickle Differential Drainage and Boiler Return System

FREE! Get all the money-saving details, complete with illustrations. Write for free Stickle Bulletin Nos. 117 (Heaters), 115 (Traps) and 250 (Return Systems). Do it today!

My Biggest Boner

► RECENTLY WE HAD TO buy six deep-well pumps for our water system. I called a pump firm and had them send their field engineer. When he arrived I gave him a complete picture of our water supply and exactly how we wanted to use the new pumps.

After a short time I received drawings and specs for the pumps. I went over them carefully, especially the items we had discussed, and approved them. The deal involved several thousand dollars.

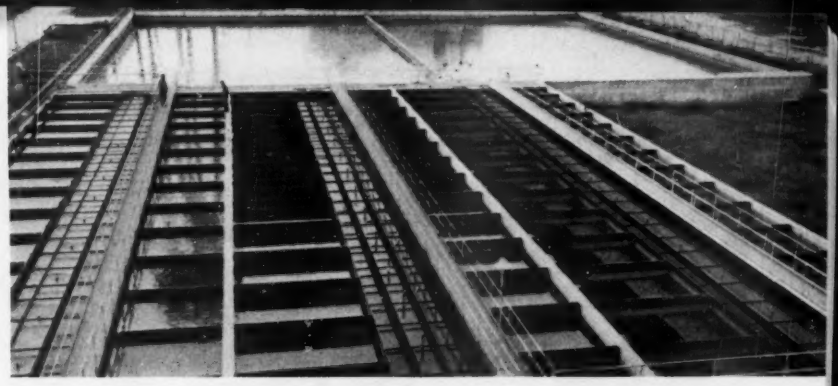
The pumps ran well for about a month after being put in. Then trouble really started. When a pump had been idle for a day it wouldn't start without blowing fuse after fuse. We found upper bearings had started to seize, some shafts were scored. The old pumps were oil-lubricated but I had checked and approved *water-lubricated* pumps when buying the new ones. Boy, was my face red.

I finally managed to rig a suitable piping system for upper-bearing lubrication but it took plenty of work. Pumps go well now but believe me, everytime I get a drawing for checking from now on, I'll look at everything through a magnifying glass. In fact I pulled such a boner I'm even thinking of using infra-red lamps.

L C VAN HUBEN
Orangeburg, N. Y.

● What is your "biggest boner"? We'll pay ten dollars for each one we publish

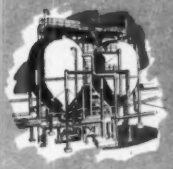
World's largest liquid rheostats, more than 20 ft high with three 9-ft-high tanks, will regulate the speed of large electric motors at a new wind tunnel in Tullahoma, Tenn., according to **Westinghouse Electric Corporation.**



Three Permutit Precipitators at Alcoa's Davenport, Iowa plant. Each processes 3,000,000 gallons of water a day.

How Permutit helps Alcoa get BETTER WATER...

THESE BASIC PROCESSES, PLUS PERMUTIT SKILL, CAN SOLVE YOUR WATER CONDITIONING PROBLEMS



1. SLUDGE BLANKET HOT LIME SODA. Application of the sludge blanket to hot lime soda treatment reduces silica in boiler feed make-up, produces high quality steam.

2. HOT ZEOLITE—PERMUTIT Q. Subsequent treatment of water from hot lime soda treatment yields effluent of zero hardness. Permutit Q, or styrene base mineral resistant to high temperatures, replaces second stage phosphate treatment.

3. SILICA REMOVAL PLUS DEMINERALIZATION. Demineralization by cold ion exchange processes produces water comparable to distilled water only at a fraction of the cost of distillation. Treatment by anion exchange resin, Permutit S, reduces silica to less than 0.2 ppm.

4. DEAERATING HEATER. The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers, by removing oxygen and free CO_2. Capacities from 12,000 to 1,400,000 pounds per hour are in service.

5. PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity, color, taste and odor. It can also be used to reduce silica.

with

LOW TURBIDITY
LOW OPERATING COST
LOW CHEMICAL COST
LOW WATER WASTE

Alcoa's water needs average 9,000,000 gallons per day in their Davenport, Iowa plant. A Permutit Precipitator processes all their mill use water, and yields an effluent turbidity of only 5 ppm from an influent turbidity as high as 900 ppm. Yet operating cost, including pumping, chemicals, depreciation and maintenance, is only 5¢ per thousand gallons. Of this, chemical cost is less than 2¢ per thousand. Water waste has averaged only 8.75%.

Precipitators for lowering alkalinity and removing turbidity of water are only one of many Permutit products for solving water conditioning problems. In the column at left, some of the more important basic processes are illustrated and described.

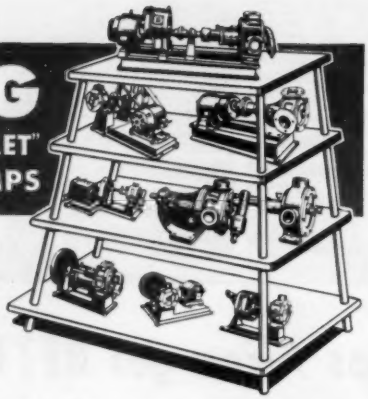
Find out how Permutit can solve *your* water processing problems. Write to The Permutit Company, Dept. P-1, 330 West 42nd Street, New York 36, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance St., Montreal.

PERMUTIT®

WATER CONDITIONING HEADQUARTERS FOR OVER 38 YEARS

VIKING

THE "SUPER-MARKET" in ROTARY PUMPS



The range in size and style of Viking pumps truly parallels the range of items found in today's super-market.

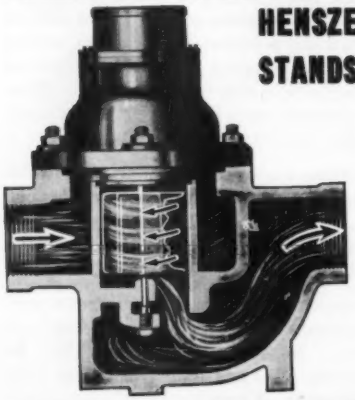
When you specify Viking, there is no compromise. They fit the job at hand.

VIKING
AN HONORED NAME IN PUMPING

Nowhere else can this *complete line of rotary pumps be* duplicated. When your needs must be fully met, consult Viking for the answer. To start, ask for Folder 52SW today.

See Our Catalog in SWEETS

Viking PUMP COMPANY
Cedar Falls Iowa



HENSZEY *Feed Water* METER STANDS UP *where others* FAIL

The cutting, abrasive action of hot, dirty Boiler Blowdown quickly breaks down meters that depend upon close clearances and intricate parts for their accuracy. Henszey Meters stay accurate—stay on the job—accurately measuring Boiler Blowdown, Feed Water, Condensate, Free-Running Chemicals and other "hard-to-measure" liquids. For details consult Sweet's Catalog or write:

HENSZEY CO., Dept. D1, WATERTOWN, WISCONSIN

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

APPOINTMENTS

Taylor Instrument Co elects Raymond E Olson president, succeeding Lewis B Swift who becomes chairman of the board. Olson is also a v-p of Taylor Instrument Co of Canada, Ltd.

Reeves Pulley Co names James A Miller mgr of Los Angeles sales and engineering office; he is assisted by Harlan M Gillis.

Allis-Chalmers Mfg Co appoints F C Ludington mgr of the Hawley Works in West Allis; Earl R Narum is assigned to the Detroit district office.

Harbison-Walker Refractories Co names Wm H Myers gen dist supt in charge of six plants, and J H Moore, Jr gen dist supt in charge of coke oven manufacture. Charles W Ayers becomes supt of the Windham, Ohio plant, Wm N Bartleson supt of the Warm Springs, Calif., plant.

Westinghouse Electric Corp promotes W B Anderson to asst to the executive v-p, R C Bergvall to mgr of engineering, B M Brown to sales mgr, and M A Dotterer to mgr of production, all in the defense products group that is now headed by L E Osborne, executive v-p. Frank L Snyder becomes mgr of the aviation gas turbine div; Tom Turner is now v-p in charge of mfg and labor relations.

Nordberg Mfg Co appoints Eighmy Equipment Co, Pierpont at W State St, Rockford, Ill., as distributor in the northwestern and central section of the state.

Read Std Corp elects Charles J Surdy a director.

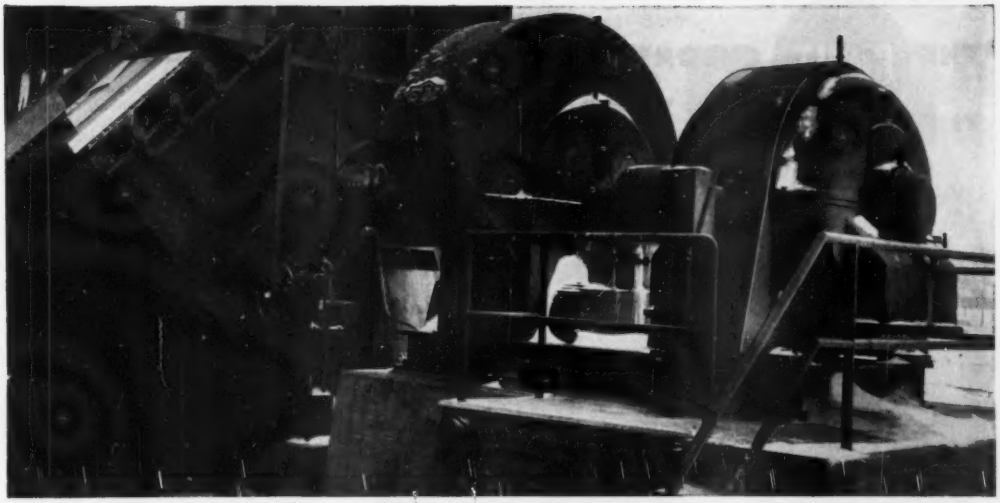
Economy Pump Div of Hamilton-Thomas Corp, Hamilton, Ohio, consolidates with C H Wheeler Mfg Co, Philadelphia, another div of the corporation. Economy Pumps will be known as Wheeler-Economy Pumps.

Perfex Corp, controls div, appoints Robert H Pratt product mgr for oil and electric appliances; Paul F Nees becomes product mgr for gas controls; and Robert E Kurrasch becomes Chicago dist mgr.

Elliott Co celebrates its 50th anniversary with special meeting of its veterans assn at Jeannette, Pa.

General Electric Co specialty transformer and ballast dept appoints H K Pritchard mgr of gen purpose transformer sales, J P Coughlin mgr of aircraft and electronic transformer sales, and A E Rowe mgr of lighting component sales. Apparatus sales div appoints Gerald L Phillippe mgr of its financial dept, and Woods McCahill counsel of its law dept.

H Arthur Howe becomes mgr of the Coshocton, Ohio, plant; Arthur T Bourgault becomes mgr of the phenolic products plant at Pittsfield, Mass. K Jerry Morray is headquarters sales specialist and Jerome T Coe is customer service supervisor at Waterford, N. Y. Milton C Lauenstein, Jr,



WHAT THE WELL DRESSED

magnetic drive

WEARS FOR OUTDOOR WORK...

Engineers inspect new Magnetic Amplifier Type E-M Regutron Control for Magnetic Drive installations similar to above. This new simplified control has no complicated electronic circuits to adjust . . . no tubes to wear out. A simple saturable core reactor amplifier system accomplishes the precise control of speed. Full information is given in Publication No. 1107 . . . sent on request.

● With building costs skyrocketing and inside floor space at a premium, a current trend in modern power plants is toward outdoor installation of equipment.

The E-M Magnetic Drive with outdoor enclosure, above, provides precise speed control for induced draft fans at The Dayton Power and Light Company, Dayton, Ohio. The Drive is dressed up in E-M's specially designed steel overcoat for weather protection. This welded steel plate enclosure has a rust resistant undercoating and is split in two sections for easy removal.

Ventilating air for the Magnetic Drive is taken in through a duct in the foundation and is discharged at the side of the enclosure . . . removable filters keep dirt and trash out. Volute contour of the enclosure is designed for proper, adequate ventilation.

The E-M Magnetic Drive, an electro-magnetic torque transmitting device, is designed to provide variable speed control of driven machines from a constant speed a.c. motor. This adjustable speed plus a.c. economy is your best answer to efficient operation of boiler draft fans. And if you're planning your installation for outdoors, remember that E-M offers the effective protection described above.

Your nearest E-M sales engineer will be glad to advise or assist you in any stage of planning . . . call him or write the factory for Publication No. 1107.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

4400-TPA-2103

THE RIGHT CHLORINE GAS FEEDER FOR YOUR PLANT . . .

It's BUILDERS Visible Flow CHLORINIZER Model HCVS —the *modern* feeder for chlorinating cooling water to condensers and heat exchangers.

Model HCVS is *the* up-to-date feeder from every point of view:

LOOK AT IT from the angle of *dependability* and you'll find a design that assures long life and low maintenance. This feeder handles chlorine gas in the dry, non-corrosive state. Double-durability is assured by the materials used in the chlorine flow system, all able to withstand even corrosive moist chlorine. Vital control parts are extremely simple and free from mechanisms which need frequent attention. Foolproof protective devices assure absolutely safe operation under all conditions.

LOOK AT IT from the *operating* point of view and you'll find equally important advantages: a Sightflo indicator that gives you a true picture of actual flow (accurate within ± 4%) — a dependable system for controlling the rate of chlorine feed by varying water or air pressure — unitized construction that can be easily understood by any competent mechanic.

LOOK AT IT from the *adaptability* angle. No other chlorine feeder is so easy to change for capacity or for type of control. Model HCVS is ready-built for proportional control; for start-stop operation; or for multiple control for dosing several points with the same feeder, simultaneously or in sequence. It holds its vacuum . . . resumes chlorine feed instantly at the start of each dosing period.

BUILDERS Visible Flow CHLORINIZERS are available in three volumetric models — for any chlorination service:

Up to 400 lbs./day	Model DVSX	Bulletin 840-F2A
Up to 2000 lbs./day	Model CVS	Bulletin 840-F1
Up to 6000 lbs./day	Model HCVS	Bulletin 840-G27

For Bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 354 Harris Ave., Providence 1, R. I.

BUILDERS PROVIDENCE *Instruments*

BIF INDUSTRIES — BUILDERS

More APPOINTMENTS

Begins on page 194

takes over silicone sales duties in Cleveland; Patrick DiCerbo is product engineer on electric insulating materials.

Bigelow-Liptak Corp moves to general offices at 2550 W Grand Blvd, Detroit 8, Mich.

Link-Belt Co announces appointment of Wm J Brinkworth as representative, distributor sales, southwestern div, with headquarters in Houston, Tex.

National Electric Products Corp appoints Henry V Ivory plant mgr of its Elizabeth, N. J. plant.

York Corp sales supervisor in the southwest dist is John H Harrison; Donald M Magor becomes v-p and controller, and Wm F Lynne secy and treas of the corporation.

Sterling Electric Motors, Inc, appoints these new distributors: Allied Bearings Supply Co, 822 S Boulder, Tulsa 5, Okla.; Berry Electric Co, 301 S 3rd St, Walla Walla, Wash.; Alabama Bearings Co, Inc, 7 Railroad St, Montgomery, Ala.; Stanley Elec Motor Co, 1520 E Miner Ave, Stockton 5, Calif.; Roy A Berentz Co, Inc, 1400 Carr, Box 564, Houston 1, Tex.

American Locomotive Co appoints Daniel J Duffin to its public relations dept.

Cleveland Chain & Mfg Co new purchasing agent is Wm W Fuller; new asst gen sales mgr is George P Long.

Dearborn Chemical Co Ltd, Toronto, adds Dr Henry C Rosenberg to its research staff to assist Dr Wm A James.

Edwin F Guth Co appoints Douty & Downie of Baltimore sales representatives for Md., Va., and Washington, D. C.

Canadian Johns-Manville Co, Ltd, appoints Karl V Lindell v-p and gen mgr of the asbestos fibre div and John C Kelleher becomes sales and merchandise mgr of that div. George K Foster is head of the new exploration dept.

Minneapolis-Honeywell Regulator Co opens new district office in Kline Village, Harrisburg, Pa. Wm J Brosch and Jack Caylor will handle sales for the Brown Instruments div, John Hopkins will handle commercial, and Donald Schmick heating controls div sales.

Timken Roller Bearing Co appoints Sherman R Lyle dist mgr of the steel and tube div, northern Pa. and N. Y. state dist. Robert E Cook becomes sales engineer at Cleveland.

Armstrong Cork Co has established a separate felt and fibrous products dept of the Industrial Div; D P Paiste is mgr of the new dept.

Chrysler Corp, Airtemp Div, appoints J

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...you get full value for every fittings dollar

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City

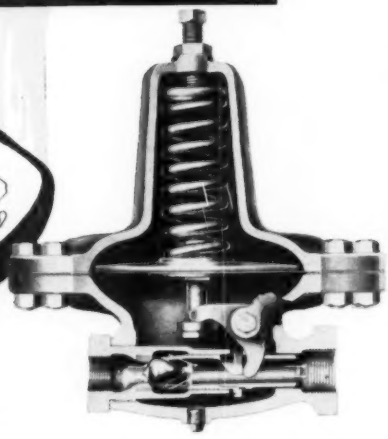
The more critically you appraise value... the more you will appreciate Ladish Controlled Quality Fittings. For the ultimate economy of Ladish Fittings is assured by laboratory, engineering and manufacturing controls unsurpassed for thoroughness and rigid standards. From metallurgy through machining ... repeated tests safeguard the extra strength and soundness vital to long dependable service ... extra value you can always depend on from Ladish Controlled Quality Fittings.

TROUBLEMAKERS

"Get the Axe"

IN PLANTS EQUIPPED WITH . . .

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVES**



USERS TELL WHY...

A Textile Mill says—
"Regarding the performance of our Streamlined Type '1000' Pressure Reducing Valves, we wish to state that we have a great many of these throughout the plant and are very pleased with them. We feel that they REDUCE COSTS and IMPROVE PRODUCTION, and we can therefore highly recommend them as they have always given us entire satisfaction."

A Laboratory says—
"The CASH STANDARD Type '1000' Streamlined Valves are the MOST SATISFACTORY VALVE we have ever tried. The slightly higher initial cost PAYS HANDSOME DIVIDENDS in LONGER SERVICE and LESS MAINTENANCE."

An Instrument Manufacturer says—
"The only thing that we can say about the CASH STANDARD '1000' Valves that we purchased from you is that the prompt service you gave us and the EXCELLENT PERFORMANCE OF THE VALVES really saved the day for us. THEY HAVE FUNCTIONED PERFECTLY ever since installation and NO SERVICE HAS BEEN NECESSARY."

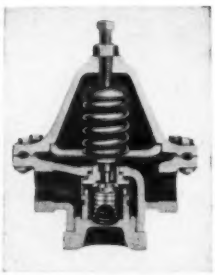
A Steam Laundry says—
"Before we installed your type '1000' Valve in our air line, the variation in pressure kept the air valves on our presses out of order a great deal of the time. Now we carry 100 lbs. air pressure on our tank and let 70 lbs. out to our presses which CUT MAINTENANCE COST and SPEEDED UP PRODUCTION because we have NO LOST TIME due to valve failure. We have had this type '1000' Valve in service for two years and have never had it apart so we have had NO REPAIR COST."

Bulletin 962
Shows why users check with these points and how you can realize them.

1. **Maximum capacity when needed most**
2. **Accurate pressure control under toughest working conditions**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

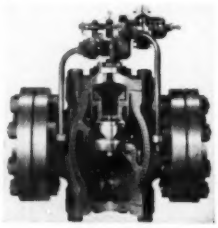
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

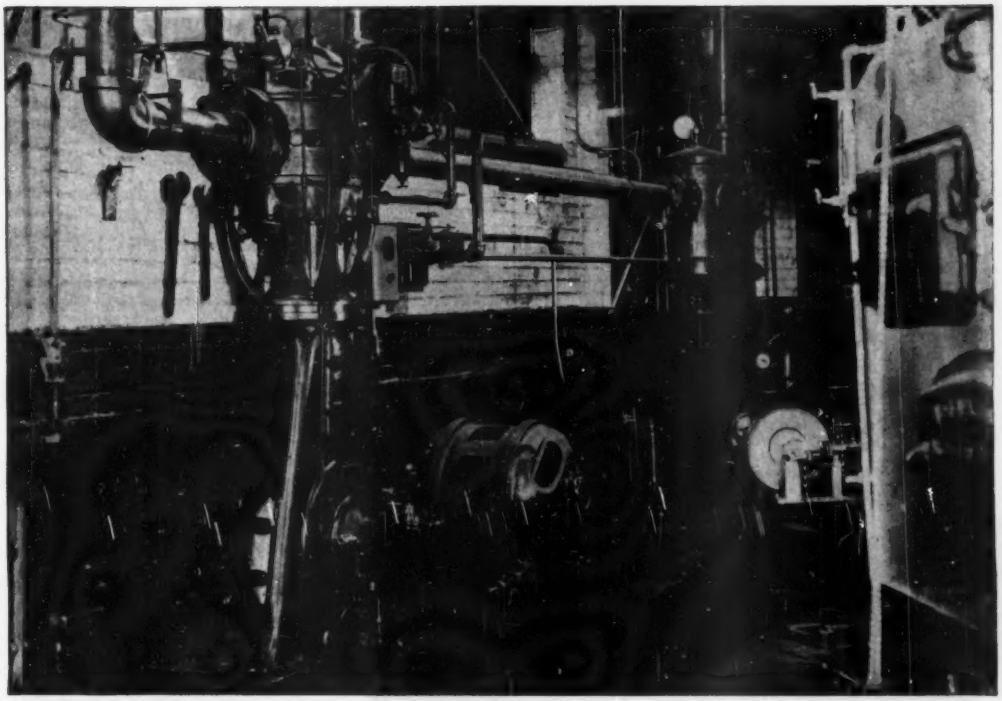
Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

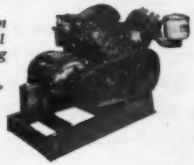


SAVE VALUABLE SPACE WITH THE EFFICIENT

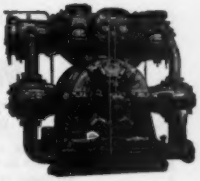
JOY WG-9 HEAVY DUTY AIR COMPRESSOR

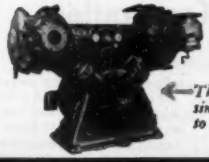
The JOY WG-9 Vertical, with its small base, saves valuable floor space. Built in a range of sizes to 881 CFM, for continuous heavy-duty service. The complete line of JOY stationary units—high and low pressure compressors, oil-free compressors, boosters and vacuum pumps—includes a type for every need, each incorporating exclusive features developed by JOY research. Supplementary products include the only complete line of vaneaxial fans and blowers, and the new JOY Oxygen Generator. ● *Write for free Bulletins.*

The JOY WL-80, in eleven sizes up to 641 CFM, with operating pressures to 125 psi. →



The JOY WN-114, in single or twin units up to 7312 CFM. →





←*The JOY WN-112, in single or twin units up to 3656 CFM.*

Consult a Joy Engineer

WAD 13786

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

. . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

Mundet Cork Corporation

Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

Mundet district offices are located in these cities:

ATLANTA
239-41 Elizabeth St., N.E.

BALTIMORE 30
612 Battery Ave.

BOSTON
57 Regent St., N. Cambridge 40

CHARLOTTE 3, N. C.
307 S. Cedar St.

CINCINNATI 2
427 West 4th St.

DALLAS 10
451 Second Ave.

DETROIT 21
14401 Prairie Ave.

HOUSTON 1
Commerce and Palmer Sts.

INDIANAPOLIS 4
15 E. Washington St.

JACKSONVILLE 6, FLA.
800 E. Bay St.

KANSAS CITY 7, MO.
1401 St. Louis Ave.

KNOXVILLE
1221 Grand Ave.

LOS ANGELES
(Maywood): 6116 Walker Ave.

In Canada:
Mundet Cork & Insulation, Ltd., 35 South Ave., Toronto

NEW ORLEANS 16
315-25 N. Front St.

NEW YORK 17
331 Madison Ave.

PHILADELPHIA 39
856 N. 48th St.

ST. LOUIS 9
3176 Bronson Ave.

SAN FRANCISCO 7
449 Bronson St.

INSULATION FOR HIGH & LOW TEMPERATURE

More APPOINTMENTS

Begins on page 194

F Knoff general sales mgr, and T B Hollencamp national service mgr. F J Laughna and M T Bard become asst sales managers and S R Prugh is administrative asst to the general sales mgr.

Cutler-Hammer, Inc, has new executive vice-president, Philip Ryan. R A Millermaster becomes mgr of the development dept, and C W Kuhn is new director of development engineering.

Dowell, Inc, promotes A C Polk, Jr to gen mgr. He is also a member of the board of directors.

Cummins Engine Co, Inc appoints R F Davis eastern regional mgr, with offices in New York City. Walter N Westland now heads Cummins Diesel of New England, Inc, at Allston, Mass. W G Turner transfers to Cleveland as mgr of the Great Lakes region, and R P Parshall is regional mgr at Atlanta.

Feedrail Corp appoints the following: R E Nugent, chief engineer; W R Jewett, asst chief engineer; W J Bulanchuk, design engineer; G H Baumann, sales mgr.

Reliance Electric & Engineering Co promotes John L Fuller to mgr of research and technical services.

United States Gasket Co appoints Harry S Stott gen sales mgr of both the gasket and packing div and the flurocarbon products div at Camden, N.J.

U S Air Conditioning Corp announces appointment of A J Mallinckrodt as chief engineer.

Whitney Chain Co appoints Harold W Beder, Jr gen sales mgr.

Norton Co appoints Clarence W Halleen to succeed Irving B Loud, who retired recently, as supt of plants 1, 2, and 3. John Matson becomes asst supt of these depts. Lorenzo S Washburn becomes quality mgr of the abrasive div, succeeding Charles J Hudson who recently retired. Gilbert H Gidley becomes abrasive engineer in Chicago, and Theodor D Meyer is appointed production engineer of the abrasive and wheel div, Norton Behr-Manning Overseas.

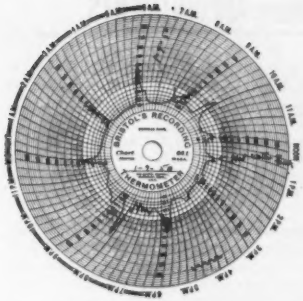
American Pulley Co appoints Harry W Gordon dist mgr in the northwest, and Sidney H Hewett dist mgr in the Detroit area.

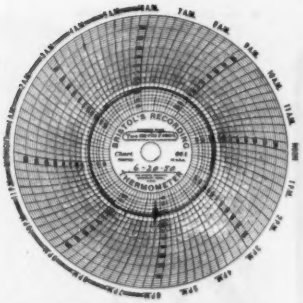
Carrier Corp elects Wm Bynam as executive vice-president.

Consolidated Engineering Corp appoints Joseph H Lancor, Jr director of the transducer div.

Graybar Electric Co, Inc has new manager of its Lansing branch—W T Bronson.

American Brake Shoe Co appoints Wm M Black president, and Joseph L Mullin





(Charts showing customer's hot water storage tank operation.)

ONE DAY BEFORE **TWO WEEKS WITH SQUIRES**

Proof of Positive Performance

WITH A

SQUIRES COMBINATION TEMPERATURE & REDUCING VALVE

RUGGED SEATS & DISCS

Maintenance is low because SQUIRES seats and discs can take punishment. Several materials are available including Age Hardened SQUIRALLOY for extreme conditions.

1 DEGREE TEMPERATURE CONTROL

SQUIRES Temperature Pilots give this control for either temperature regulators or Combination Pressure and Temperature Regulators.

PACKLESS VALVES

SQUIRES valves available in packless construction through 3".

"STRENGTH WITHOUT STRAIN" IN PATENTED DIAPHRAGM

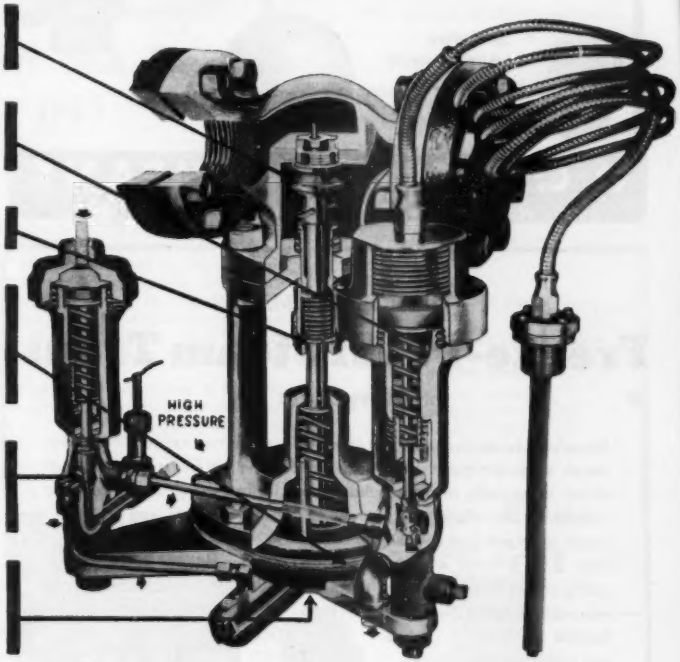
Only in SQUIRES do you get a composition rubber diaphragm protected by 2 brass diaphragms. Thus, you get the flexibility of rubber combined with the durability of brass for years of dependable trouble-free operation.

PRESSURE CONTROL WITHIN OUNCES

The heart of accuracy in SQUIRES Reducing Valves lies in the Pilot Resistance Plug. Large Valve area at the top gives quick opening of main valve when necessary. Small bleed around stem cushions valve closing and sensitizes control.

POSITIVE DEAD-END CONTROL

Only in SQUIRES Patented Valves does full High Pressure dead-end the main valve. For example, 100 lb. of initial pressure through the Pilot Resistance Plug in the 1¼" valve shown, makes 3,000 lb. of force available on the main diaphragm for dead-ending the valve.



In the SQUIRES Combination Valve illustrated above, the Temperature Pilot is connected in series with the Pressure Pilot. It maintains a constant temperature at all times and holds the reduced pressure to a predetermined maximum. With just *one* SQUIRES Combination Valve, steam pressure can be reduced from 600 lb. initial pressure to ounces in just one step. At the same time, as shown in the charts above, temperatures are maintained to within 1 degree plus or minus.

These are some of the main reasons why SQUIRES Valves are your best investment—initially and in the years to come. Get the full facts *today* by writing. Ask for Bulletin #103-A.

THE C. E. SQUIRES COMPANY

Over 50 Years of Dependability

18502 SYRACUSE AVENUE • CLEVELAND 10, OHIO

KECKLEY

FLOAT VALVES

for dependable, accurate liquid level control!

Controlling the liquid supply to open tanks is easier and more dependable when you do it with Keckley balanced float valves. They're engineered to give you long service with minimum maintenance—and protect you against costly failures that disrupt processing operations. The balanced feature insures constant even flow and positive closing action regardless of the incoming pressure. Keckley float valves are available in sizes from ¼" to 12". Screwed, standard or extra heavy flanged connections.

- No. 15 Balanced inner valve double seat. Pressures to 125 lbs.
- Specify No. 14 single seat float valve where tight closing is required.
- Bronze bodies, integral seats ½" to 1½" inclusive. Semi Steel bodies, bronze trim, renewable seats, 2" to 12" inclusive. Globe or angle patterns.
- Seamless copper floats standard. Stainless Steel floats available.
- Closed tank controls also available.

SEND FOR YOUR COPY OF NEW CATALOG 51-A

O. C. KECKLEY COMPANY

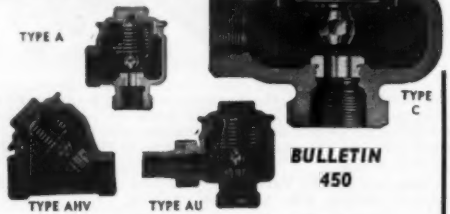
400 W. MADISON STREET CHICAGO 6, ILLINOIS

NICHOLSON MAKES

Freeze-Proof Steam Traps

for Every Plant Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non - air - binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Size ¼" to 2"; pressures to 225 lbs.



BULLETIN 450

125 OREGON ST., WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

More APPOINTMENTS

Begins on page 194

v-p of the electro-alloys div. Walter G Hoffman becomes asst to the v-p for research and development.

National Gypsum Co appoints Frank D Davis public relations mgr, replacing David A White, Jr, who is on active duty with the U S Air Force.

Quaker Rubber Corp, div of H K Porter Co, Inc appoints J J Merkel and E E Klemm branch mgrs of the Detroit and Cleveland districts, respectively.

John Reiner & Co names Herman B Robbins sales mgr of the generator set div.

J D Wilson Co, Inc, moves its Milwaukee office and warehouse to new quarters at 4831 W State St.

American Air Filter Co, Inc announces formation of American Air Filter of Canada, Ltd, Montreal, P. Q. Wm G Hole will be in charge of all Canadian operations.

U S Rubber Co appoints H Barden Allison dist sales mgr of the Philadelphia branch.

Vapor Recovery System Co establishes a manufacturing affiliate in France—Compagnie Technique des Petroles, 134 Boulevard Haussman, Paris. Zarry Toula is managing director.

Dominion Bridge Co, Ltd, appoints W Taylor-Bailey president and gen mgr, succeeding W F Angus who died recently. A H Cowie becomes vice-president, gen mgr, and a director of the company.

Dominion Engineering Works Ltd, appoints Hubert G Welsford president and managing director, succeeding the late W F Angus. W Taylor-Bailey, becomes vice-president, H S Van Patter a director, and Russell J Barrett v-p and asst to the president.

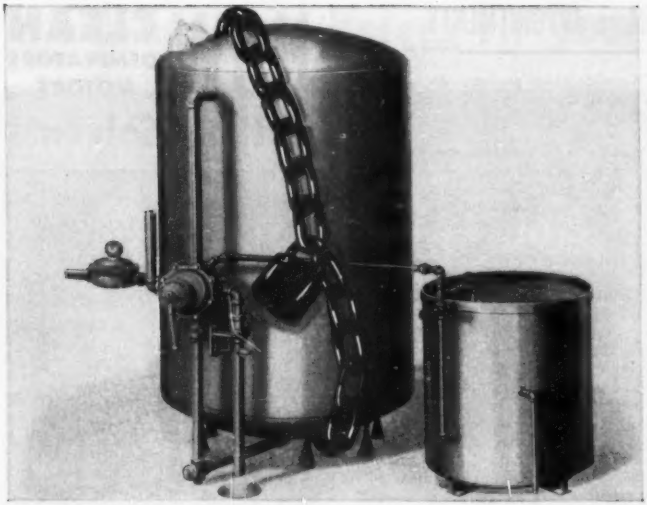
Fitzgibbons Boiler Co appoints John M Dooley representative for the Knoxville, Tenn. area.

Ajax Electric Motors Corp moves to new location at 1138 Mt Hope Ave, Rochester, N. Y.

Automatic Transportation Co appoints Harvey J Hincker chief engineer of the automatic dept.

Canadian Locomotive Co, Ltd, appoints J F Weiffenbach v-p in charge of manufacturing succeeding J J Jarrell, who has retired.

Borg-Warner Corp reports appointment of A J McAllister as president and gen mgr of the Detroit gear div; Robert J Minshall is pres and gen mgr and G V Patrick v-pres and asst gen mgr of the



The Softener with the Zeolite LOCKED IN!

No longer just a new idea, the Elgin Double-Check zeolite softener is today a thoroughly proved reality. It now stands on its record in hundreds of plants as the biggest water softener development in recent years.

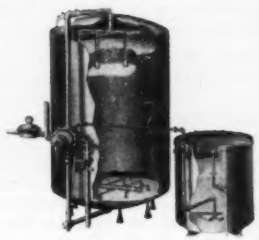
One simple but revolutionary change from the old way accomplished this. It can be described in five words: *the zeolite is locked in.*

Yes, the zeolite is locked in by the Elgin Double-Check manifolds. Softeners not having the Double-Check are forced to use shallower zeolite beds and employ slower backwash rates to prevent the escape of zeolite through the old-style un-checked manifolds. But the Elgin, with the Double-Check manifolds to lock in the zeolite, can use more zeolite, and backwash it and regenerate it far more effectively. That's why it gives up to 44% more soft water per regeneration in a softener of given size containing a given type of zeolite.

While the zeolite water softener alone may not be the answer to all water conditioning needs, it is the most basic unit . . . and Elgin leadership in this field is typical of Elgin leadership in all phases of water conditioning which includes complete boiler and process systems of all types, individualized water treatments, deionizers, filters, purifiers, degasitors and so on down the list.

The Elgin story — one experienced source for all needs — is told in the new 20 page catalog briefly outlined opposite. The coupon brings your copy.

ELGIN SOFTENER CORPORATION
130 North Grove Avenue, Elgin, Illinois
Representatives in Principal Cities



The ingenious upper and lower Elgin Double-Check manifolds mechanically prevent escape of zeolite; permit deeper zeolite bed; better regeneration; greater zero-soft water output at lower cost.

ADAPTABLE TO ANY WATER SOFTENER

ELGIN
Economical
WATER CONDITIONING
FOR EVERY NEED
SINCE 1908

The scope of Elgin service covered in
BIG NEW CATALOG

Here are some of the subjects:

Elgin Water Softeners
—advanced features described in detail

Softener Modernization
—dollar saving ways to step up capacity of present softeners

Ultra-Deionizers
—give mineral-free water; remove silica and CO_2

Elgin Systems
—for boiler and process water conditioning

Filters — Purifiers — Degasitors
—for removal of sediment, iron, oil contamination, gases, etc.

Water Treating Chemicals
—feedwater, supplementary, corrosion prevention, etc.

Engineering Services
—complete facilities

Coupon Brings Your Copy

Please send your new catalog to:

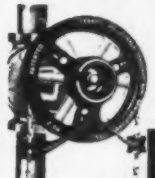
NAME_____

COMPANY_____

ADDRESS_____

Mail to ELGIN WATER SOFTENER CORPORATION, 130 N. Grove Ave., Elgin, Ill.

Overhead Valves EASILY, QUICKLY AND SAFELY controlled from the FLOOR!



Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

● Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

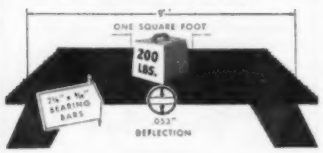
● No more climbing up treacherous step-ladders, on benches, machines or boilers. High-up, inaccessible valves are brought down to earth by the inexpensive BABBITT Adjustable Sprocket Rim with Chain Guide. Here's overhead valve control that is just as positive as direct manual control, and 100% safer—right from the floor!

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

● *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

For STRENGTH specify TRI-LOK RECTANGULAR OPEN STEEL FLOORING



The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. Get maximum strength, air and light with minimum weight.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company
Dravo Bldg., Pittsburgh 22, Pa.
Sales Representatives in Principal Cities

More APPOINTMENTS

Begins on page 194

Marvel-Schebler products div. Louis P. Smith is mgr of the Ithaca plant, Morse Chain Co.

Baldwin-Lima-Hamilton Corp announces new assignments—John S Newton is in charge of the locomotive div; Raymond B Crean has complete responsibility for the Southwark div; James R Weaver is responsible for the new defense and special products div.

Burndy Canada, Ltd, announces these staff changes: Bryce Kell becomes gen sales mgr; Fred W Patterson is eastern dist mgr in Montreal; Jack K Harding joins the Montreal staff; Roy Bunston becomes chief engineer.

Allied Radio Corp promotes Alex Brodsky to merchandising mgr, S H Levey to sales mgr; J W Rubin is sales promotion and advertising mgr L M Dezettell is purchasing agent.

San Diego Gas & Electric Co appoints Emery D Sherwin president, succeeding A E Holloway, who retires. Harold A Noble becomes vice-president.

South Carolina Electric and Gas Co appoints J M Costello executive v-p and a director of the company, and Harold A Petit v-p and Charleston div mgr.

Charles T Main, Inc, has additional office at 317 Tryon St, Charlotte, N. C.

Economic Commission for Europe appoints H W A Waring director of its steel and power div.

National Electrical Mfr's Assn elects J F Lincoln of the Lincoln Electric Co president. New vice-presidents are Arthur A Berard, Ward Leonard Electric Co; J W Corey, Reliance Electric & Engineering Co; J H Jewell, Westinghouse Electric Corp; Alan F Sheldon, Kennecott Wire & Cable Co; Hoyt Post Steele, Benjamin Electric Mfg Co.

OBITUARIES

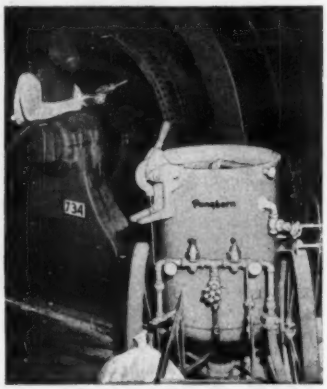
Elmer H Horstman, 52, chief engineer of the steam turbine section of Allis-Chalmers Mfg Co's power dept, died of a heart attack Nov 24.

Leon R Ludwig, 47, director of engineering and research for Westinghouse Electric Corp's atomic power div and former mgr of the company's Buffalo plant, died Nov 14 at Pittsburgh, Pa.

Robert N Blakeslee, 58, v-p and director of engineering of Ajax Electrothermic Corp, died suddenly on Oct 17.

Raymond Charles Force, 71, first president of Caterpillar Tractor Co, and a member of its board of directors, died Nov 15 in Oakland, Calif.

NOW CLEAN GENERATORS MOTORS Without Solvents



NO Drying Period Toxic Hazards

with New Pangborn AC-4 Blast Machine

NOW YOU CAN clean electric motors, generators and turbines *without solvents!* The new Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. with soft (20-mesh) corncob grits.

Since no liquids are used there is no need for drying periods and toxic or explosive hazards are eliminated. Large equipment can be cleaned *in place* and no residue is left to create gum or to break down insulation.

Simple and Inexpensive

New Pangborn AC-4 Blast Machines operate from a standard 40-pound air supply. Material costs average 1/10 of other methods and complete cleaning is finished in half the time.

FOR DETAILS, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn
BLAST CLEANS CHEAPER with the right equipment for every job

S-E-Co. Coal Valves Fit Your Requirements

S-E-Co. Coal Valves are built in many types and sizes so as to fit your requirements. Valve sizes are 12", 14", 16", 18", 20", 24", 30" and 36". Top flanges may be either square or round. Bottom flanges may be either square or round. Top flanges may be either drilled for bolts or furnished with studs. All sizes of these Coal Valves are equipped with **S-E-Co.** patented U-shaped gate which assures easy valve operation.

S-E-Co. Coal Valves are also built for use in inclined downspouts. These valves have a disc brake built into the pocket sheave so that the gate plates are not self-closing. Inclined valves also have their centerline offset 2" so as to insure good coal flow through the coal valve.

In addition to the above standards we can furnish valves built to your particular requirements.

SEND YOUR INQUIRY TO **STOCK EQUIPMENT COMPANY**

715 P HANNA BUILDING • CLEVELAND 15, OHIO

When You Think of

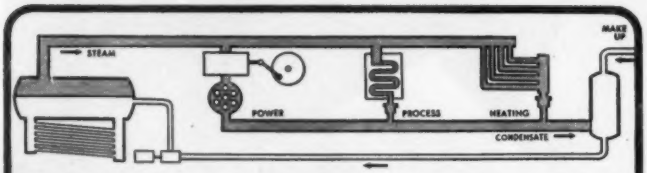
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS)

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

Western Chemical Company,
713 Washington Street,
Kansas City 6, Missouri

Send me full information about CORAVOL.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____

STATE_____

More FREE BULLETINS

Begins on page 163

units, guide rollers. Stephens-Adamson Mfg Co, Aurora, Ill.

B33 **ELECTRIC TRUCKS** — Motorized hand trucks and electric stackers, *Worksaver* line. 16-page bulletin No. P809 shows construction, attachments, capacities. Yale & Towne Mfg Co, 11000 Roosevelt Blvd, Philadelphia 15, Pa.

MECHANICAL TRANSMISSION

B34 **ROLLER CHAINS**—Double pitch. Drive and conveyor types. 12-page bulletin No. 51-2 gives details on all types and standard attachments. Charts, photos, diagrams, tables. Chain Belt Co, 1600 W Bruce St, Dept PR, Milwaukee 4, Wis.

B35 **V-BELTS** — Precision balanced, *Comdor* line. 4-page folder No. 6868-E gives construction features, installation photos, table of standard sizes and list prices. Raybestos-Manhattan, Inc, Manhattan Rubber Div, Passaic, N. J.

B36 **HYDRAULIC CYLINDERS**—Standard and cushioned types, for pressures of 1500 psi max, special cylinders to 3000 psi. Keeper-ring construction. Catalog No. 105 gives complete information, working drawings, specifications on 108 different models. Rivett Lathe & Grinder, Inc, Brighton 35, Boston, Mass.

METERS AND INSTRUMENTS

B37 **TELEMETERING** — 4-page instrumentation data sheet No. 9.1-10 describes system variable measurement with wire speed transmission to central locations. Requirements, application, equipment, operation discussed. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

B38 **CONTINUOUS BALANCE SYSTEM**—Amplifier-motor combination. 24-page bulletin No. B15-12 describes the circuit and discusses component characteristics. First in a series of bulletins to aid in adaptation of *Electronik* equipment to specialized applications. Minneapolis - Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

B39 **MEASURING CIRCUITS**—16-page bulletin No. B15-13 discusses characteristics of measuring circuits used in the Brown *Electronik* potentiometer. Second of a series in using this instrument for specialized measurements. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

B40 **INSTRUMENT PANELS**—Cabinet type. Self-contained units, standard cutouts. Dimensions, specifications, prices. 4-page bulletin No. P1-2. Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.

B41 **OSCILLOGRAPH** — High-speed, direct-writing type. Pen deflection linearity 1% with pen response 1/120 sec. Applications, construction details, specifications. Offner Electronics, Inc, 5320 N Kedzie Ave, Chicago 25, Ill.

B42 **THERMOMETERS** — Indicating and recording types. 4-page specification sheet No. 600 gives construction, dimensions, operation. Minneapolis-Honeywell Regulator Co, Industrial Div, Station 40, Wayne and Windrim Ave, Philadelphia 44, Pa.

PIPING, VALVES, FITTINGS AND SPECIALTIES

B43 **BRASS TUBING** — Fittings, valves, drain cocks. 8 pages of catalog information. Sketches, prices. Universal Brass Corp, 855 Kearny Ave., Arlington, N. J.

★ **METAL HOSE AND BELLOWS**—16-page catalog No. CMH-123 gives specifications in quick-reference

New!

CLIPPER "CONVERTIBLE" MASONRY SAW

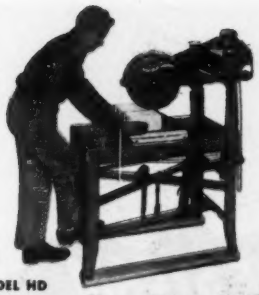
•

FIRST you buy a CLIPPER MASONRY SAW *and* Then at any time you can add the "CONVERTIBLE" CART

Try it yourself . . .
ON FREE TRIAL

Order TODAY . . . on FREE TRIAL. Discover for yourself how Clipper will increase production . . . cut costs . . . increase profits. Only through the Clipper FREE TRIAL are you guaranteed . . . ACTUAL TEST on the JOB . . . FULL SATISFACTION . . . NO OBLIGATION! . . . If you prefer, order your Clipper Masonry Saw now . . . and the Clipper "Convertible" Cart when the need arises.

One of Nine Models from $265



① MODEL HD used as DRY MASONRY SAW

③ MODEL HD "CONVERTIBLE" CART used for SAWING CONCRETE

Four Entirely Different Ways to Profit with Handy CLIPPER "CONVERTIBLE"

④ MODEL HD "CONVERTIBLE" CART used for TRACK SAWING

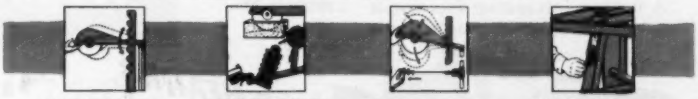
② MODEL HD used as WET MASONRY SAW

SO MANY WAYS TO USE IT . . .
You Can Save Money on Any Size Job!

With the Model HD you can cut . . . Glazed Tile, Concrete Block, Flooring Tile, Face Brick, Stone, Glass, etc., but in an instant you can "convert" to sawing patches, trenches in building floors, walks, or runways by placing the cutting head on the "CONVERTIBLE" CART. No more fractures beyond removal lines—no more spalling.

But wait . . . if you have bulky stone slabs, pre-cast stone, transite sheets or plywood and masonite to cut . . . just place the "CONVERTIBLE" CART on tracks and operate as a TRACK SAW!

MAXIMUM ECONOMY in MASONRY CUTTING ONLY POSSIBLE with these EXCLUSIVE CLIPPER FEATURES



SELECT-A-NOTCH
● One man easily adjusts Cutting Head to desired height . . . Whether cutting 12" or 1" material. Operator's hands merely guide. Weight supported by rear Bar.

PRESSURE EQUALIZER
● Makes your blades last longer . . . Because Equalizer Spring automatically cushions blade pressure whether cutting HARD or SOFT materials. Outstanding for blade economy.

ADJUST-A-CUT CONTROL
● Pull the knob—and the Cutting Head is free for finger-tip setting at any desired angle. Release the Knob—and Head is locked in the desired position.

SAVE-A-BLADE DIAL
● Just turn the Save-A-Blade Dial to the material hardness and the Pressure Equalizer Spring automatically sets the tension — guarantees faster cutting and longer blade life.

Clipper
KANSAS CITY 8, MISSOURI

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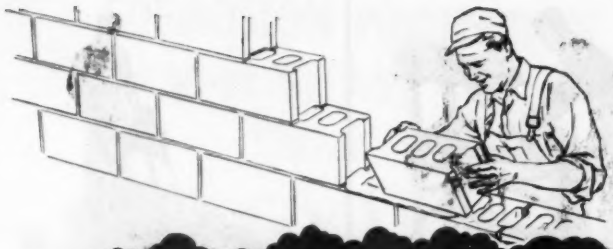

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CURES CEMENT BLOCKS IN 54 TON AUTOCLAVES . . . AT HARTER MARBLECRETE

KEWANEE

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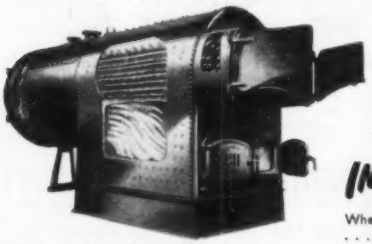
• In the modern plant of Harter Marblecrete Stone Co., at Oklahoma City, cement blocks are cured with high-pressure steam at 135 to 150 psi in five of the *largest autoclaves ever built.* (Pictured above)

A further interesting fact about this outstanding development is the use of a 26-inch vacuum, pulled with an Elliott barometric condenser, for the drying stage.

High pressure steam is provided by a gas fired 300 hp Kewanee Boiler producing 10,500 pounds of steam per hour.



Cut-a-way View of KEWANEE "500" used in Harter Marblecrete Plant. Sizes for 40 to 304 hp . . . 100-150 psi.

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More FREE BULLETINS

Begins on page 163

form. Characteristics, complete size ranges, applications, recommended uses. ★Request on company letterhead. Chicago Metal Hose Corp, Maywood, Ill.

PUMPS

B44 JET PUMPS—20-page bulletin No. 512 gives catalog information on steam or air operated jet ejectors, water jet exhausters. Installation, operation and maintenance details, dimensions, sizes, prices, applications. Penberthy Injector Co, 1242 Holden Ave, Detroit 2, Mich.

★ **ROTARY PUMPS** — Vane type. Suction pipes 2 to 12 in., discharge lines 2 to 10 in. Capacities 25 to 1000 gpm. 4-page bulletin No. W-485-B1 gives dimensions, ratings, drawings. ★Request on company letterhead. Worthington Pump and Machinery Corp, Harrison, N. J.

★ **WET-PIT PUMPS**—*Freeflo* pumps for sump, sewage and drainage service. Non-clogging impellers. Bulletin No. W-317-B12 has drawing, dimensions, flange data. ★Request on company letterhead. Worthington Pump and Machinery Corp, Harrison, N. J.

B45 SUBMERSIBLE PUMPS — For deepwell pumping in wells with 6 in. inside dia or larger. 30 to 130 gpm, heads from 80 to 770 ft. 4-page bulletin No. 51-5300 has photos, capacities, installation advantages. Byron Jackson Co, P O Box 2017, Terminal Annex, Los Angeles 54, Calif.

B46 CONTROLLED-VOLUME PUMPS—Reciprocating, positive displacement plunger type, for high or low pressures. Simplex, duplex, or special unit models. Pump any liquid from heavy viscous liquids to light solvents, liquefied gases, etc. 24-page bulletin No. 251 has dimensions, adjustments, photos, design features. Milton Roy Co, 1300 E Mermaid La, Philadelphia 18, Pa.

OTHER EQUIPMENT

B47 STOCK CATALOG—Machine tools, material - handling equipment, shop equipment. System of 3-dimensional *repro-templet* planning. 80-page catalog. Visual Planning Equipment Co, Inc, Pennsylvania Ave at River, Oakmont (Allegheny Co), Pa.

B48 ULTRASONIC TESTING — Laboratory and field testing service for checking material thickness up to 4 in., testing for flaws. 8-page bulletin No. 50-115 and price schedule. W C Minton, Service Supervisor, Sperry Products, Inc, Danbury, Conn.

B49 STEEL FLOORING — 16 - page Booklet, *Versatile — Open Steel Flooring*, shows types and features, installation photos, specifications. Open Steel Flooring Institute, Inc, 2311 First National Bank Bldg, Pittsburgh 22, Pa.

B50 POWER EQUIPMENT REBUILT—Methods of rebuilding and remodeling diesels, generators and motors. Sherman Benjamin, Sales Mgr, BFM Industries, Inc, 2124 Mill Ave, Brooklyn 34, N. Y.

B51 PLANT DESCRIPTIONS — Descriptions of plant and electrical power plant projects completed by the firm. 18 pages. Winger Construction Co, Ottumwa, Iowa.

B52 LIQUID STORAGE TANKS—Diaflote type with membrane to eliminate breathing and lling losses, prevent contamination. For storing high volatile, high purity, deaerated, corrosive and inflammable products. Capacities to 100,000 bbls. 8-page bulletin No. 51DF. Illustrations, descriptions. Hammond Iron Works, 630 Fifth Ave, New York 20, N. Y.

B53 INCINERATORS—For dry waste, garbage, special purposes. Standard sizes to 4000 lbs per hr. Also refractory linings. 16-page bulletin file No. 35-J-41. Photos, installations. Plibrico Jointless Firebrick Co, 1300 Kingsbury St, Chicago 14, Ill.

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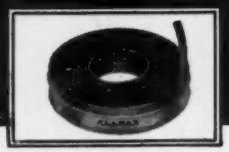

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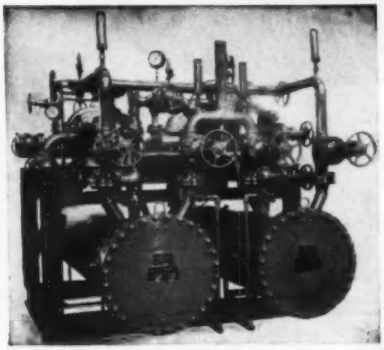

The compact, high-pressure unit illustrated consists of two, Turbine-driven Rotary Pumps and two, Shell-and-tube-type Oil Heaters mounted on a single frame.

FOR almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

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MARMADUKE

Continued from page 142

next fall, we'd work those dredges around the clock and wouldn't need a watchman.

"'Make sure that guy makes his rounds on all dredges and keeps them pumped out,' cautioned Pete. 'There may be some seepage in the bilges. I don't think the old guy I'm sending over has been aboard anything but a canoe. So show him how to pump the bilges and brief him on things to keep an eye on.'

"When the old watchman showed up I took him around and told him what I thought he should know. While he looked around, I got my gear and started to shove off. When I got to the *Jefferson's* stern, I found him staring down at the river through the port spud well. Her spud had been damaged and was not installed as yet. Only the starboard spud anchored her and it was down through its well.

"'Hey, chief,' yelled the watchman, 'this here is the dangdest hole I ever did see. I better plug her fast afore she sends this dredge to the bottom.'

"I looked at the guy. Was he pulling my leg? No, he was on the level and he even seemed scared.

"'Don't worry too much about it,' I kidded him, trying to look serious. 'Get that 4-inch hose I showed you in the locker and hook it up to the emergency pump's suction side. As long as that pump runs, this water can't gain any.' Then I shoved off fast before he got wise and bawled me out for stringing him along. I though he'd probably get over my little joke by the time I showed up next morning.

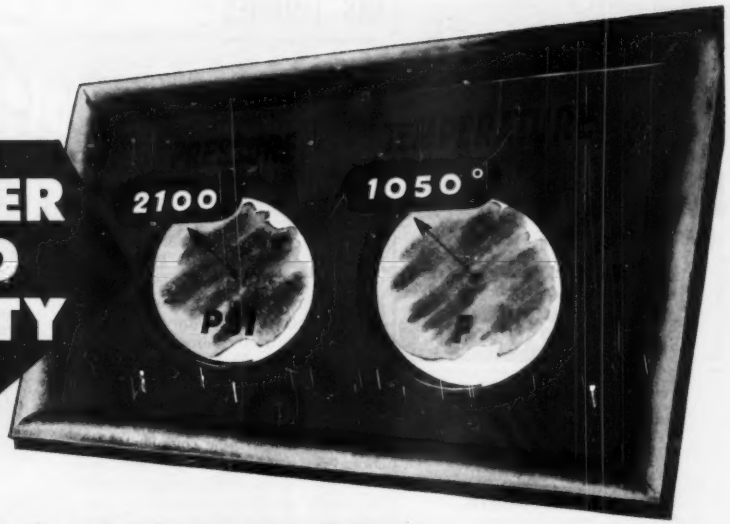
"When I got aboard after breakfast next day, there was the old codger, with his eyes glued on that spud well. Sure enough, he had one end of that 4-inch hose down that spud well and the other end on the pump. I nearly keeled over. Looked like he'd been pumping the whole Missouri River through that hole all night long, just like I jokingly told him to do.

"'I see you still got this dredge afloat,' I greeted him, wondering if I should cuss him out or bust out laughing. 'How's she doing?'

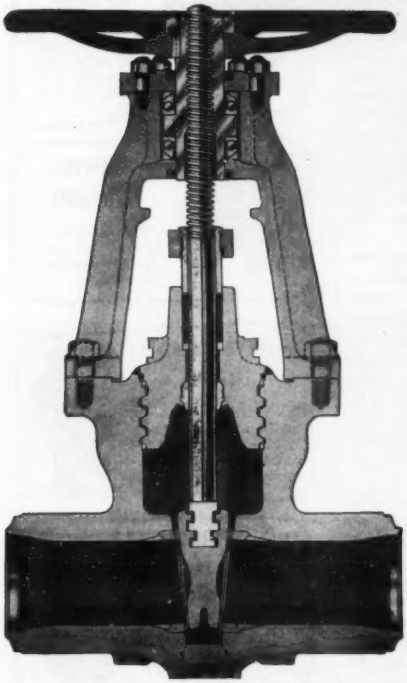
"He looked up and rubbed his sleepy eyes. Then he answered hopelessly, 'Danged if I can get that pump to gain any, chief.' After a pause he brightened up and added, 'BUT BY GOLLY, I SURE GOT HER HOLDING HER OWN.'"

EDITOR'S NOTE: Be sure to be on deck next month when Marmaduke sounds off about running a steam threshing engine out in the middle of a wheat field.

POWER AND SAFETY



WITH **LUNKENHEIMER**



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Breech Lock Valves

Your high-pressure, high-temperature lines are *safely* controlled with leak-proof Breech Lock steel valves, rated at 1500 lbs. S.P. and used in central power stations at pressures up to 2100 lbs. or 1050°F. The exclusive Breech Lock design follows the principle used on large guns, except that locking is not accomplished by a thread wedging action. Rather, four series of three heavy annular lugs on the body and in the bonnet intermesh and lock the two parts together. Stress is evenly distributed and the full internal pressure acting against the bonnet is carried by the breech lugs. Pressure tightness is maintained by sealing the seam or joint with a seal weld, which can be chipped out to remove the bonnet, if necessary.

The combination of locking lugs and seal weld possesses a strength and structural stability not attainable in any type of construction that must depend on some form of gasket for pressure-tightness. *Leakage is impossible, and maintenance never required.* In effect, the Breech Lock with Seal Weld has all the advantages of the Strength Welded Bonnet design, plus the added advantage of easy disassembly and reassembly in the field.

NOTE THESE ADVANTAGES:

Eliminates bonnet-joint leakage under the most severe operating conditions. No maintenance required. ★ Provides for ready disassembly and reassembly in the field. ★ Bonnet-joint tightness unaffected by rapid temperature changes. ★ No sealing surfaces to become damaged by corrosion, oxidation, or in disassembly, and thus prevent reassembly of a pressure-tight joint. ★ No flanges, gaskets, or bolts that will require periodic maintenance attention. ★ Seal weld makes a leak-proof joint. ★ Compactness of design reduces weight and bulkiness. ★ Contour of body and bonnet lends itself to good foundry practice, resulting in sound, dense castings.

Write for your copy of "Lunkenheimer Cast Steels," a brochure describing basic research in alloys for high-pressure, high-temperature valves. Address: The Lunkenheimer Company, Box 360-A, Cincinnati 14, Ohio.

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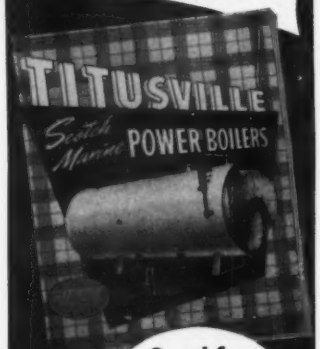

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THE TITUSVILLE IRON WORKS CO.
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GAS TURBINES

Continued from page 75

Boeing feels that raising engine efficiency can be achieved by improved aerodynamic performance of centrifugal compressor and axial-flow turbine elements. In addition, possibility of using cheaper fuel oils will alleviate relative thermal inefficiency. For more detail see "Progress of Gas Turbine Truck Tests," by H C Hill, SAE Paper No. 668.

Radial Inflow Turbines. The francis turbine used in the hydroelectric field is an example of a radial inflow turbine. The working fluid enters the wheel from the outer perimeter, directed through suitable nozzles. The same principle is used in small gas and air turbines employing high rotative speeds. Fig. 7 shows three forms of centrifugal impellers, ranging from completely unshrouded to completely shrouded. These rotors can also be used as turbine wheels by simply reversing direction of flow from periphery to wheel center. Fig. 10 shows an example of a radial inflow turbine where the rotor is similar to the center wheel in Fig. 7.

Fig. 12 shows two types of radial inflow turbines. The one at left, a cantilever arrangement, carries moving blading resembling those of axial-flow turbines. Wheel hub helps turn gas flow to an axial direction after passing through moving blades. The wheel at right employs a 90-deg impeller in which the moving blading helps turn the gas through 90 deg into an axial direction while exhausting.

These high-speed turbines have been used by the thousands on aircraft as auxiliaries performing a wide variety of functions. Fig. 13 shows a miniature refrigeration turbine (used on aircraft) with cantilever blading driving a single-stage axial-flow compressor. For more detail see "Single-Stage Radial Turbines for Gaseous Substances With High Rotative and Low Specific Speed," by W T Von Der Nuell, ASME Paper No. 51-F-16.

Wood-Burning Gas Turbine. The Oregon Forest Products Laboratory on the Oregon State College campus announced that an experimental 200-hp gas turbine consumed 600 lb per hr of mill waste sawdust with a moisture content as high as 55%. The wood is burned under pressure, the combustion products passing directly through the turbine. Exhaust gas can be used for drying lumber. A pilot plant has been planned for completion in about two years. It will be used in a 6-month test run in a small operating sawmill.

Seagoing Gas Turbine. A 1200-hp gas turbine replaced one of four diesel electric engines in the British 12,000-ton

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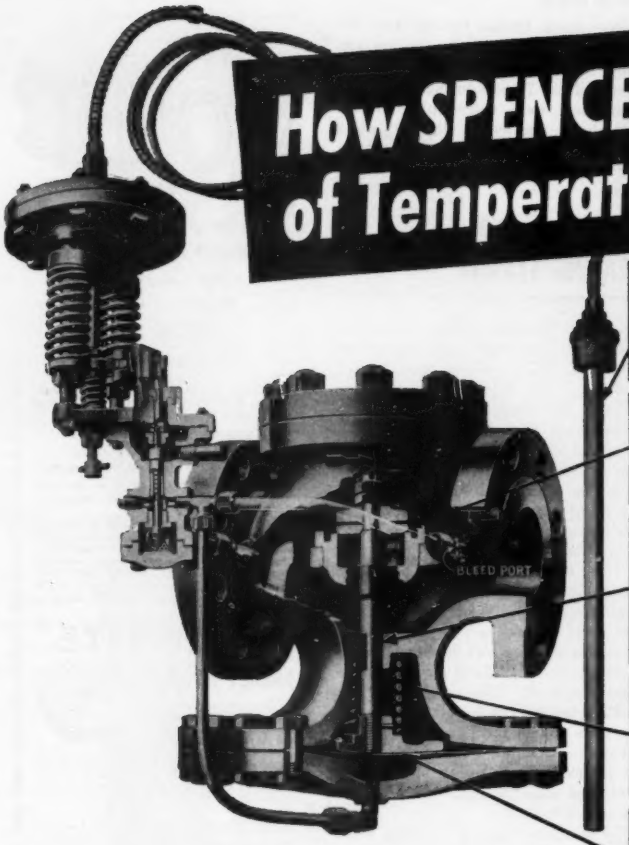
How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wire-draw.

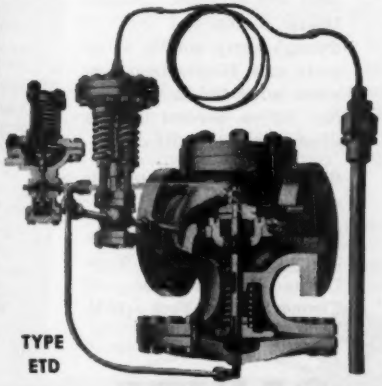
PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

PROTECTED SPRINGS — Springs in the Spence Regulator are out of the path of the steam or other fluid flowing through the valve.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.



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Spence

SPENCE ENGINEERING COMPANY, INC.
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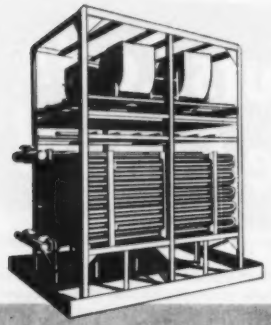

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tanker *Auris*. During the sea trials the ship was driven solely by the gas turbine for a 6-hour period. The ship averaged over 7 knots during this period. The trials were successful, vibration was absent, and only a slight whistling noise was evident. Immediately after the sea trial, the tanker set sail for Texas.

HEATING SYSTEM

Continued from page 85

deaerator directly as in the right-hand sketch. In the rearranged layout this pipe now stands full of water at all times.

Vent line from the flash tank was reconnected to enter the top of the deaerator along with the drip line. This avoided the possibility of the flash tank filling up with water and spilling into the bleed line with disastrous results in the turbine. This could happen if the drip pump failed to run.

These two changes didn't affect the hammering in the steam-supply lines and drain lines of the heating coils. When full heat wasn't needed, the control valves feeding some of the heating coils would be partly closed or even completely shut off. Cold air going by the coils cooled and condensed the steam in the coils and in the lines to and from the coils. Later, when steam flow would be increased, hammering started and continued until the cold water drained out of the lines.

To overcome this we installed additional traps to drain the steam lines from control valves to coils. It was still possible, however, for the steam to force itself back from the flash tank through the main condensate traps, and back into the heating coils if they had little or no pressure in them. This would fill them with water. We licked the possibility by installing check valves just ahead of the main traps, preventing water or steam flow from flash tank back into the coils.

Finally, we lowered the horizontal portion of the drain lines from traps to flash tanks a few inches. This insured a pipe full of water, preventing steam from the flash tank entering a pipe partly full of water that was possible in the original arrangement.

Results. System now runs with little or no water hammer and the coils can be cut in or out of service from the control room without trouble or extra attention. We found that keeping water and steam separated kept the system happy, to say nothing about the operators! No longer is the sweet purr of the plant blasphemed by the unholy racket of water trying to go through steel walls.

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of approximately 95,000 gallons of water yearly—costing:

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If a hot water faucet, like (actual) FUEL WASTED heating [illegible] gallons costs approximately:

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$84.41 if gas (84,411 cu. ft.)

Above figures authenticated by Hackensack Water Co. and American Gas Association.

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FAUCET WASHERS

...a modern laboratory triumph, are compounded from du PONT NEOPRENE (tested up to 300° F.) instead of rubber—to withstand DESTRUCTIVE HEAT common in present-day super-heating water systems—that formerly broke down washer's structure.

Built like a tire with fabric re-inforcement they resist the grinding, closing squeeze that SPLIT and MUSH ordinary washers out of shape... causing LEAKS.

Through combining NEOPRENE and FABRIC RE-INFORCEMENT they OUTWEAR ordinary washers 6-to-1 on hot or cold FAUCETS—thus you slash water, fuel and labor costs.

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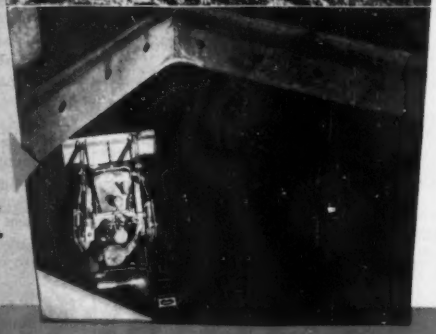
HD-30 Tracto-Shovel stockpiles coal as it is unloaded from railroad cars at Crown Cork and Seal Co., Baltimore, Md. Also used to load into trucks.



HELPS UNLOAD —

Canada Cement Co., Montreal, uses HD-30 Tracto-Shovel with dozer to pull coal and cement from sides and ends of ship hold into reach of crane bucket. Eliminates hand shoveling, speeds up unloading.

By Using Versatile Allis-Chalmers Tractors *you can*

- Handle *all* of your coal storing and reclaiming — or supplement existing facilities.
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WATER SOFTENERS

Continued from page 81

split these complex basic carbonates into their simple components, Fig. 6. Then they'll drop right out. What's more, the coagulant precipitates out as aluminum hydroxide, a heavy voluminous, gelatinous floc, that blankets any suspended solids and speeds up their rate of descent. This action cuts down the detention time, lowers the load on the filters. It is particularly helpful in the cold-process system.

Alum (aluminum sulfate) and sodium aluminate do equally well as coagulants. Sodium aluminate, though, has other qualities that make it more desirable. It's alkaline nature fits in better with lime-soda conditions, and its color-absorbing property makes it still more attractive.

But there are problems that can come up. Under the influence of high alkalinities like those maintained for softening, aluminum may dissolve to form complex alumino-silicate scales within the boiler. The higher the boiler operating pressures, the more likely that this extremely tough, adherent scale will deposit on the tubes.

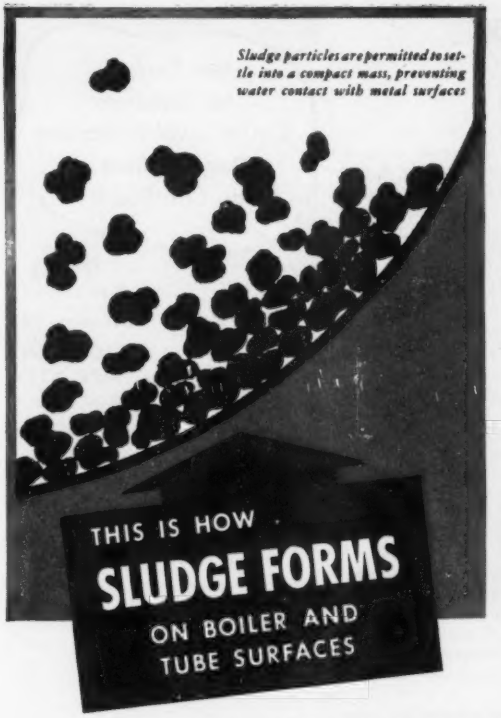
How can you avoid it? Use these coagulants sparingly. Confine them to cold-softened low-silica makeup waters of moderate pressure boiler systems.

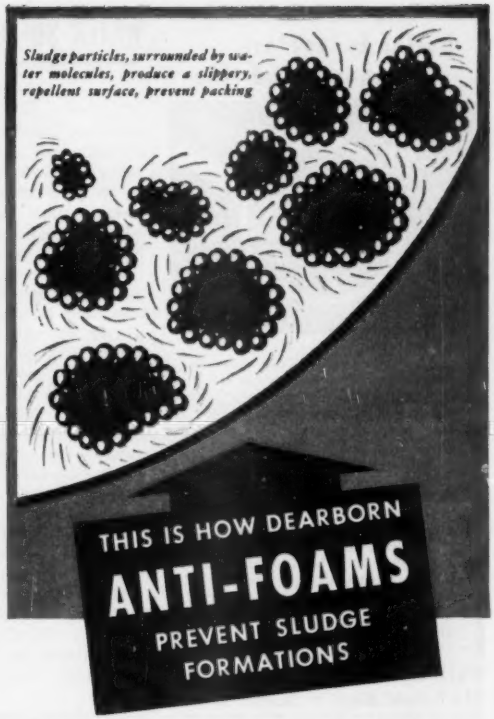
Contaminant Removal. No matter what lime-soda softening method you select—cold with coagulation or hot alone—resulting turbidity, even with a raw water heavy with sediment, can be lowered to no more than 10 ppm as silica.

Removal of gases dissolved in raw water constitutes still another problem. In the cold process, lime unites with dissolved carbon dioxide, Fig. 8, to chemically remove it. The hot process, on the other hand, expels both free carbon dioxide and oxygen mechanically as raw water undergoes heating. The cold process, then, requires more lime for this part of water-treatment job.

Dissolved iron and manganese often contaminate well waters. Fig. 7 shows how lime precipitates them out as hydroxides. These new products, very similar in their nature to the hydroxide of aluminum, Fig. 6, act like it to screen the treated water of suspended matter.

Silica reduction is another desirable treatment you can carry out in the single unit of a lime-soda softener. For instance if you use dolomitic limes (the oxides of calcium and magnesium in various proportions) you release silica-absorbing magnesium hydroxide, Fig. 9, under the alkaline conditions maintained for softening. Dolomitic limes prove least expensive. They offer savings in cost of lime and impart no


Sludge particles are permitted to settle into a compact mass, preventing water contact with metal surfaces
THIS IS HOW
SLUDGE FORMS
ON BOILER AND TUBE SURFACES


Sludge particles, surrounded by water molecules, produce a slippery, repellent surface, prevent packing
THIS IS HOW DEARBORN
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4. Anti-Foam No. 659 prevents corrosion in feed lines, heaters and internal boiler surfaces caused by dissolved oxygen.

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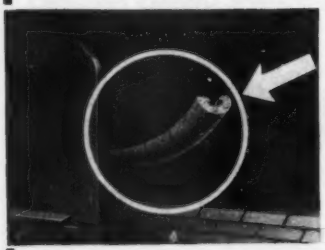

The outside laps of the plates at the girth seams of riveted HRT boilers are liable to buckling and cracking, due to overheating. Often the rear head seam is similarly affected.

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WATER SOFTENERS

Continued from page 216

additional dissolved solids to the make-up water since both their main components are virtually insoluble, Fig. 9. But to get an ultimate low of 2 ppm of residual silica for the treated water with the cold process you'll have to employ fairly large dosages.

With the exception of the dolomites, magnesium hydroxide precipitated from cold water by other correctives acts as a coagulant only and shows no silica-absorptive ability. This holds true for calcined magnesite, magnesium carbonate, magnesium sulfate and specially activated or lightly roasted magnesium oxide preparations. Yet if you raise the temperature of the water, each one proves quite capable of extracting silica.

At boiling temperatures, for instance, the soluble silica content of a raw water can be pulled down to as low as 0.5 ppm. Cost of doing the job or materials you would use vary widely, depending on the chemical and physical characteristics of the water you're working with. Sometimes putting together certain corrective measures instead of one alone brings better results and saves money.

It's always smart practice to keep a close control over the density and the height of the sludge bed. Mostly because silica removal increases in proportion to the amount of absorptive surface. You can get better clarification with a lower residue of soluble silica by recirculating a small portion of the sludge drawn off. For instance as much as 50% further silica reduction can come from a 10% sludge return in the hot process.

Filtration is usually a necessary follow-up to lime-soda softening because you can't always afford the time or space to permit complete settling of all precipitates. What's more, filtration is a valuable aid in forestalling after-deposits of unsettled precipitates in a plant's feedwater system. Best filtering medium is graded, crushed anthracite coal or iron ores. Sand in the presence of a highly alkaline softener effluent gives up harmful silica. And the pick-up is even worse in the hot process. So it can't be used.

Let's stop and sum up the case for lime-soda softening. A raw water high in total hardness, suspended matter, color, silica, iron and manganese can be effectively softened, clarified, and have its silica content greatly reduced. Initial cost runs fairly high. What's more, the system gives only a limited removal of hardness while requiring attentive control. Yet despite these dis-

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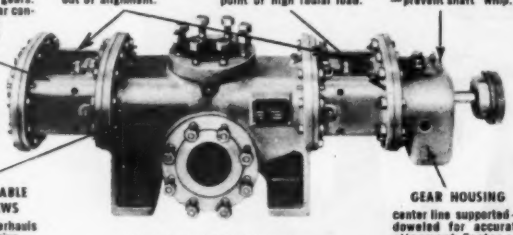

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WATER SOFTENERS

Continued from page 218

advantages the good it can do usually far overshadows them.

Modified Lime Soda. Every so often you'll come across a water requiring some modification of the basic lime-soda system. For instance, a water much higher in alkalinity content than in total hardness. With straight lime-soda softening the effluent can have too high alkalinities. Gypsum (calcium sulfate) fed in conjunction with lime decreases the raw-water alkalinity by converting the weakly alkaline sodium bicarbonate, Fig. 10, to a neutral sodium sulfate. The exact alkalinity level you get depends on how closely you control the feed of gypsum.

Caustic soda as a means of modifying the system works in highly special cases and requires such extreme care that it is employed only under specific instructions.

Barium carbonate, coupled with lime, reduces dissolved solids content of a feedwater by precipitating the sulfate out as barium sulfate. But because barium salts are poisonous and expensive you'll find their use greatly limited.

For cooling-water supplies, calcium is often more troublesome than magnesium. Selective calcium softening, with only soda ash, frequently is enough. And with domestic installations, lime alone is satisfactory and economical.

CONDENSERS

Continued from page 91

vertical condensate pump has made a substantial contribution to reducing condenser headroom. The casing of this pump usually sets in a hole in the basement floor mat, the suction and discharge connections remaining above floor level.

The condensate enters the pump through the annular space formed by the outer and internal casing. First-stage impeller at the bottom of the pump, being submerged, picks up the water and passes it through successive stages to the discharge nozzle. The single stuffing box at the top of the pump is always under full discharge pressure, eliminating air leakage into the condenser through this path. The suction connection can be located anywhere along the length of the outer casing up to the mounting flange.

Fig. 9 shows that the hotwell bottom can be set directly on the floor. Occasionally the hotwell extends into the basement mat, waterboxes being left above the floor so tubes can be easily

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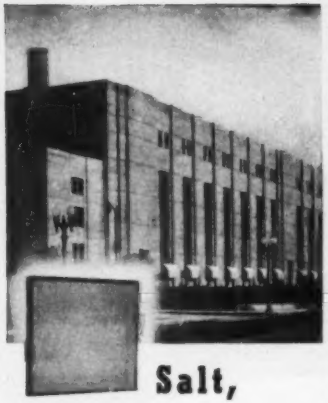

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Located 150 yards from the ocean, the Southern California Edison Company's Redondo Steam Plant had a difficult air filtration problem. The blowers were located in the wall facing the ocean and the wall openings were covered by concrete hoods facing toward the ground. The corrosive salt air contained a large concentration of dust and sand, and it was necessary to handle a large volume of air—240,000 CFM—even though the design of the hoods made filter space limited.

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removed. Sometimes the hotwell is only inches above the floor with a dam around the edge to prevent accumulating trash underneath. In these arrangements the hotwell bottom must be protected against corrosion by moisture.

Some plant designers eliminate deaerators in the feedwater cycle. A well-designed condenser can do all the deaerating needed under favorable conditions. But it is well to remember that many factors can upset these conditions to the extent that deaeration may be inadequate under adverse situations. Air leakage and capacity of air-removal equipment affect deaeration, as do low circulating-water temperatures, quantity and type of makeup, other factors.

WITH OUR READERS

Continued from page 5

ing color coding of piping? That is, the color that a plant engineer would paint pipes to distinguish between air, oxygen, acetylene, steam, etc.

Easton, Pa. E R GRAUERT

In one form or another, this question occurs frequently among the many we receive. So we're using Grauert's letter to put the facts on the record. Such a code has been set up by the American Standards Association and is designated as A-13. It can be obtained from Publications Sales Dept, American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. ($0.60) per copy). Briefly, it provides five standard colors to designate the type of fluid carried in pipes — dangerous materials, safe fluids, fire protection, protective materials and valuable materials. These colors are used on the entire body of the pipe, on flanges, or as broad bands at intervals. For specific identification of fluids within these broad groups, secondary stripes or stenciled legends may be included.

POWER's Data Sheet No. 110 (Oct 1941) summarized the principal provisions of this code, with practical suggestions on application. Perhaps we should bring out a new color-coding Data Sheet—what say?—*Ed.*

More POWER NEWS

Continued from page 190

ft. A heavy-concrete shield 3¼ ft thick, made with barytes as aggregate—obtainable in a natural state from Tennessee quarries—weighing 220 lb per cu ft, provides a shielding effectiveness equal to 1 ft thickness of lead.

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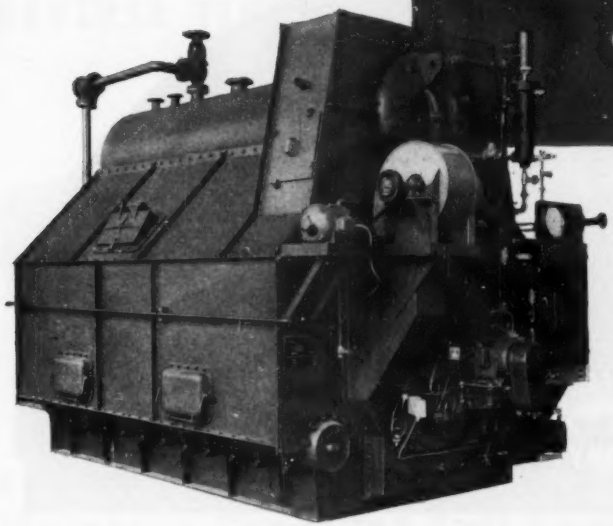

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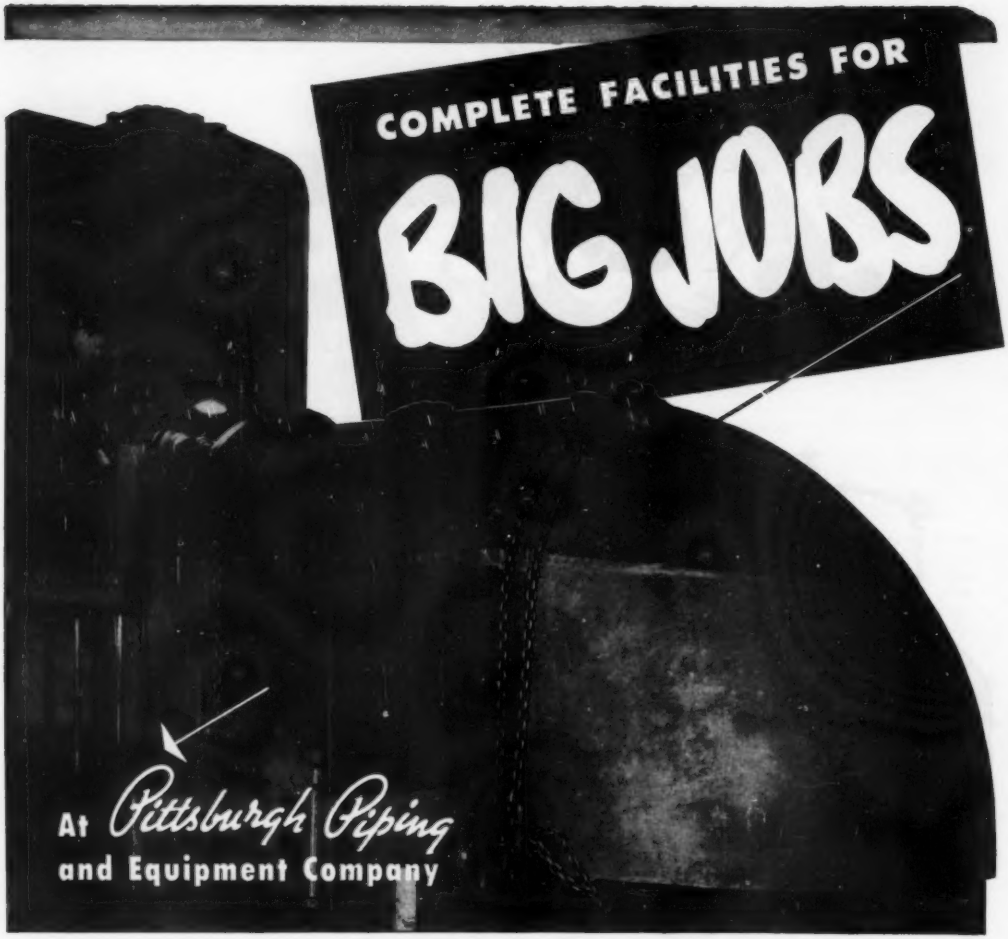

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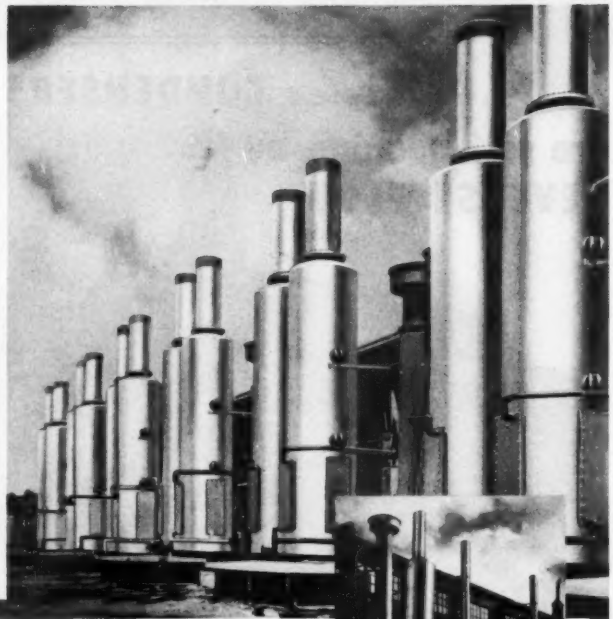
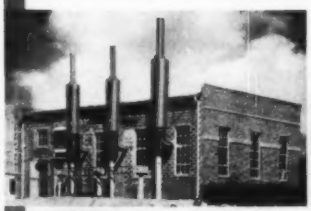


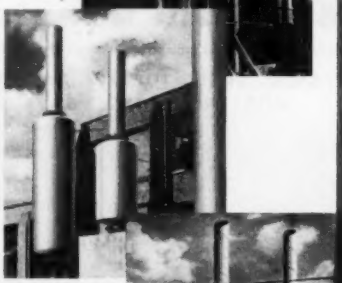
MEXICO—Nordberg Diesels equipped with Snubbers

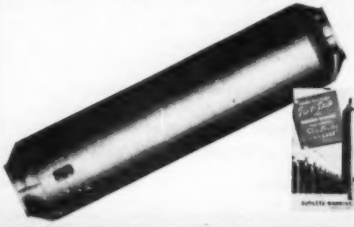
MICHIGAN—Nordberg Diesels equipped with Snubbers



NEBRASKA—Fairbanks-Morse Diesel engines equipped with Snubbers

WISCONSIN—Three Burgess-Manning Snubbers on Worthington Diesels



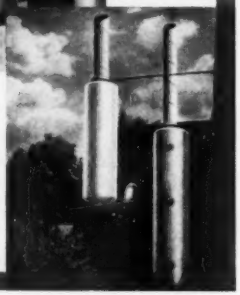


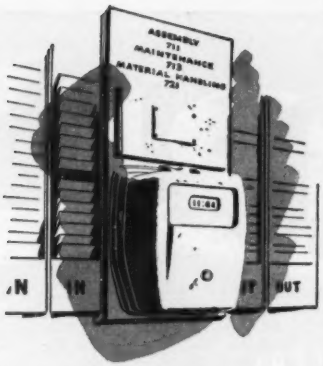
OHIO—Municipal light plant equipped with Exhaust Snubbers

WRITE FOR BULLETIN

"Bring Your Plant Up to Date With Burgess-Manning Heavy-Duty Slug Buster Snubber."

MICHIGAN—Diesel Electric Power Plant equipped with Snubbers on Fairbanks-Morse engines





A BOILER THAT PUNCHES THE TIME CLOCK

Yes — a Cleaver-Brooks Boiler "Punches In" to meet a heavy steam demand — "Punches Out" during low load periods.

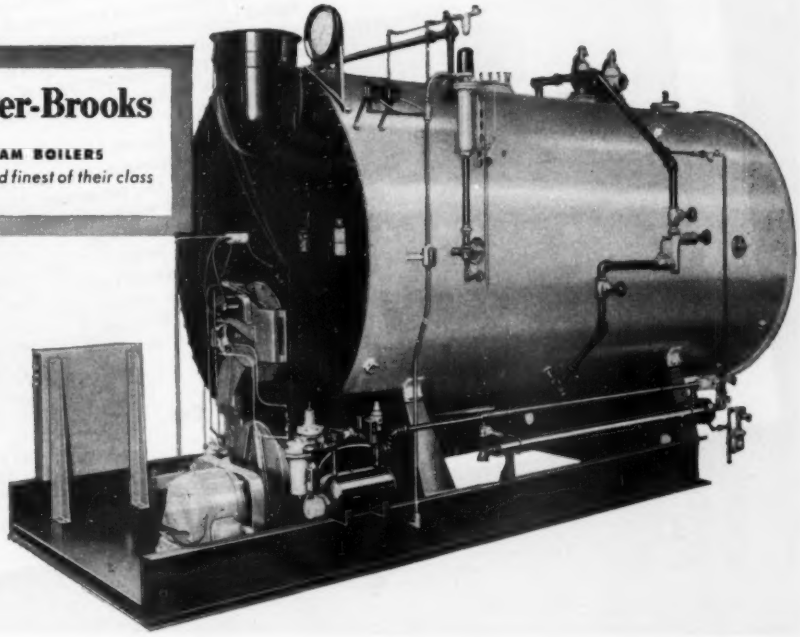
Steam costs can eat deeply into profits when steam loads fluctuate — or are intermittent. With a Cleaver-Brooks boiler you are equipped for heavy or light . . . steady or variable loads, operating at full 80 per cent efficiency over the entire working range of the boiler.

You are assured of fuel economy through high heat transfer. *All* Cleaver-Brooks boilers are of the four pass design and the maximum useable heat is absorbed in these four passes before the combustion gases leave the boiler.

Remember the name Cleaver-Brooks if you are considering a change in your present boiler plant. Think about flexibility and get the complete facts about Cleaver-Brooks Self-Contained Boilers — standard models in 15 to 500 HP, 15 to 250 psi, oil, gas, combination oil and gas fired — 80 per cent efficiency.

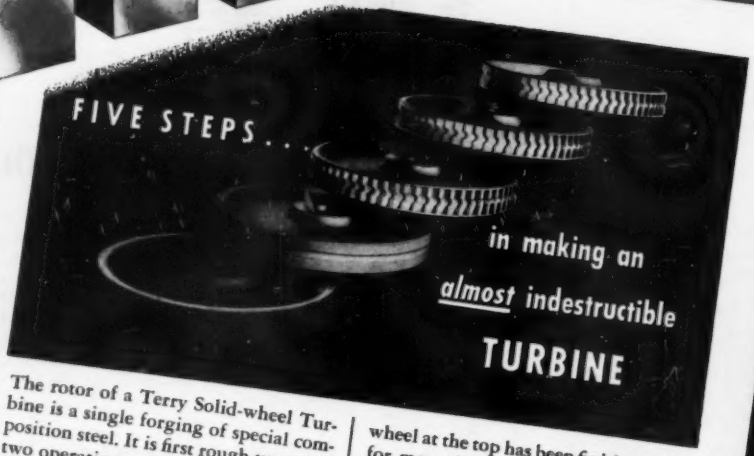
CLEAVER-BROOKS COMPANY
300-A E. KEEFE AVE., MILWAUKEE 12, WIS.
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment Oil and Gas-Fired Conversion Burners

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

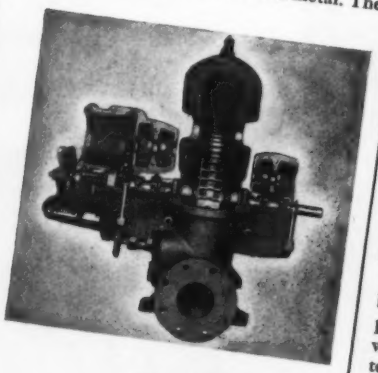


Write for the latest graphically illustrated Cleaver-Brooks Boiler Catalog. It tells and shows how you can save money with a Cleaver-Brooks Boiler installation.

TERRY



The rotor of a Terry Solid-wheel Turbine is a single forging of special composition steel. It is first rough turned in two operations, as illustrated, and then two cuts are taken to mill the semi-circular buckets from the solid metal. The wheel at the top has been finished, ready for mounting on the shaft. *The result is a single-piece wheel with no parts to loosen or work out.*



As the only function of the blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

It is impossible for the blades to foul. They have large clearances, and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry Solid-wheel Turbine is an extremely reliable piece of equipment. Why not write for complete details today?

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1188

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

This 'dust' man is worth his weight in gold–to you

He's the man behind the most efficient, most economical method of collecting nuisance dust.

There are still many industrial men who have yet to sit across the desk from an industrial dust engineer–a man who may be actually worth his weight in gold to you.

If you are one of these men, you have a revealing half-hour in store–a half-hour that can show you the most efficient, low-cost way to eliminate the escape of objectionable nuisance dust…to raise employee morale…to boost plant-community relations.

The reason? Buell's staff of industrial 'dust' men draw on more than 200 man-years of experience in the design and construction of high-efficiency, trouble-free Dust Collection Systems. You will learn of the success of hundreds of Buell Installations. You will learn how one can be designed for you.

Buell van Tongeren Cyclones in series with Electric Precipitator provide high-efficiency collection of Fly Ash at a large Eastern Utility.

For full information about Buell Dust Collection and Dust Recovery Systems, write today. Ask for the new illustrated Buell 'Dust Collection' bulletin. It can be a highly profitable move. Buell Engineering Company, Dept. 50-A, 70 Pine Street, New York 5, N. Y.

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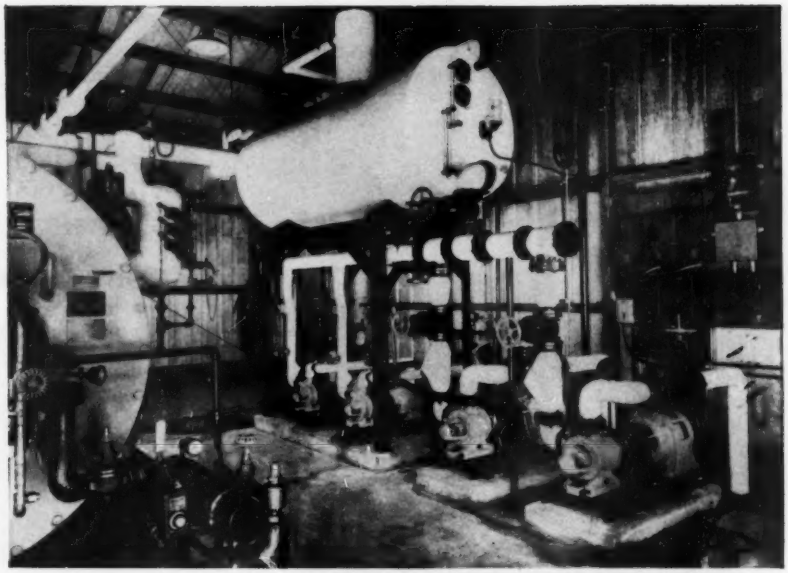
ENGINEERED EFFICIENCY IN DUST COLLECTION

HIGH EFFICIENCY CYCLONES • ELECTRIC PRECIPITATORS
TYPE 'LR' COLLECTORS • LOW DRAFT LOSS COLLECTORS
SPECIAL PURPOSE COLLECTORS • DUST HOPPER VALVES

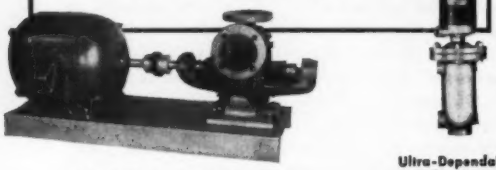


Schaub Duplex Deaerator System, installed in a new Pacific Northwest plant, handling one 100 H.P. and one 800 H. P. packaged boilers, 150 lbs. working pressure.

You Get MORE in a SCHAUB

BOILER RETURN SYSTEM

THIS EXCLUSIVE COMBINATION OF *"Plus Values"* TELLS WHY:

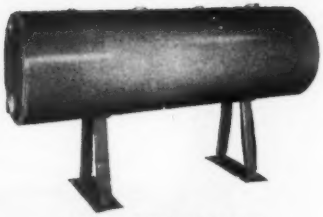


Schaub Master-Bilt Turbine Pump

Patented fleximatic shaft seals and prelubricated ball bearings mean no packing and no greasing — *ever!* When you install a Schaub Master-Bilt Pump you can forget about it.

Ultra-Dependable MAGNETROL Boiler Water Level Control

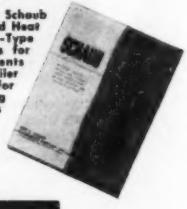
Combination pump control and low water safety cut-off. Friction-free Magnetrol assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.



Chromosoid-Lined Receiver

10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected against costly and premature replacements. No more rust-clogged systems.

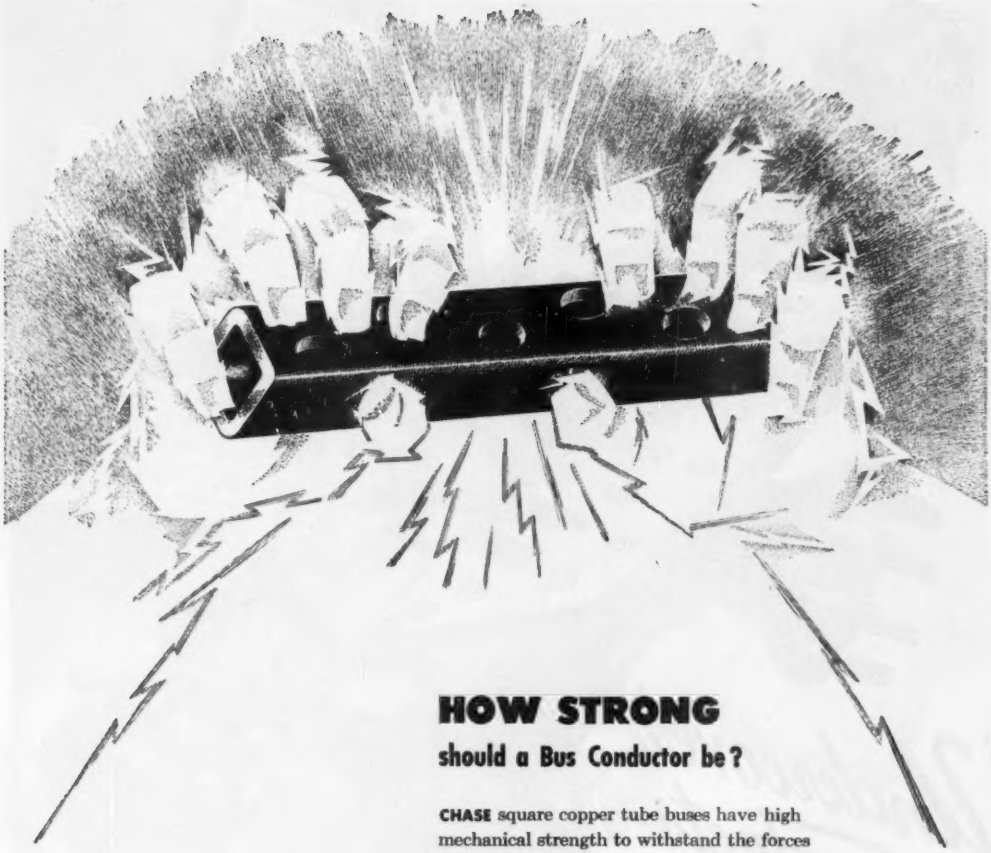
Each of these, along with other features, combine to produce the high overall efficiency, economy and long-lasting service characteristic of every Schaub System. Operators who buy on the basis of facts and performance find that they get more out of a Schaub System because a Schaub System has *more to give.them.* When a Schaub System is compared with any other, the *least* difference is the difference in price! That's just another way of saying *you pay less per year for a Schaub System.*



Know the Facts! Schaub also builds Patented Heat Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 boiler horse power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.

FRED H. SCHAUB ENGINEERING CO.

2105 S. Marshall Boulevard • Chicago 23, Illinois



HOW STRONG
should a Bus Conductor be?

CHASE square copper tube buses have high mechanical strength to withstand the forces caused by heavy short circuit currents. They have relatively large cross-sectional areas to give maximum structural strength. This permits longer spans between supports without unduly large sags.

Easily assembled and erected . . . with high thermal conductivity and low resistance voltage drop and power loss per pound of metal . . . these bus conductors are well worth your consideration. Write Dept. PO 152 for the Chase Bus Conductor Handbook.

Chase BRASS & COPPER

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• *The Nation's Headquarters for Brass & Copper*

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Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)

Minimum Span, Oversize Casing Studs
Proof against cutting between stages on uniform pressure on gasket. On Warren TH Pumps, extra heavy bolting is especially close to channel rings and are spaced and oversized to provide uniform pressure and lock flanges together for maximum strength. (Inner bolts 1¾", outer bolts 1½")

Locked Channel and Case Rings . . .
Inter-stage seals or channel rings are not only wide to reduce by-passing between stages to minimum, but to make it possible to place casing bolts close to rings for maximum and uniform pressure on gasket. Double flange in lower half and single flange in upper half assures secure locking of channel and casing rings.

Genuine Kingsbury Thrust Bearing
Made by Kingsbury Machine Works, not modified type of other make. Oil cooled, heavy duty, duplex ball thrust bearing available and practical for discharge pressures 800 p. s. i. and lower.

"Undercover" facts—

why WARREN six stage, type TH high pressure boiler feed pumps are a most dependable investment.....

There are many other important factors designed to provide a sound investment over the years. Evaluate the benefits and contact Warren on your next high pressure boiler feed job. Write for Bulletin 244 giving further details.

P-28

Trouble-Free Solid Discharge Nozzle
Discharge nozzle is flared and extra heavy, with studs, instead of the conventional flanged type nozzle, thus eliminating danger of breakage.

Extra Heavy Casing Flanges . . .
To provide freedom from warping, casing flanges are not only extra heavy but each bolting point is backed up with heavy boss providing highest possible strength.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN MASSACHUSETTS

Stopping Rust with RUST-OLEUM 769 D.P. Red Primer

RUST-OLEUM

Look for this label: Be sure it's genuine RUST-OLEUM!

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All Colors, Aluminum and White—Beautifies As It Protects!

This practical coating may be applied directly over surfaces already rusted without removing all the rust! Simply wirebrush and use sharp scrapers to remove rust scale and loose particles . . . sandblasting and chemical pre-cleaning are not usually required. Easy to apply by brush, dip, or spray . . . dries to a firm, pliable coating. Cut your maintenance costs, save metal — with RUST-OLEUM! Prompt delivery from Industrial Distributor stocks in principal cities.

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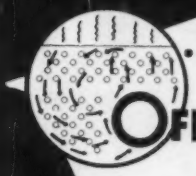
Check First with Dutton

FOR ONLY THE DUTTON ECONOTHERM
GIVES YOU OFF-CENTER FIRING



AND
...HERE'S THE EXTRA ADVANTAGE OF
OFF-CENTER FIRING

Induces positive, fast water circulation in a rotary motion, resulting in uniform water temperature in shell . . . faster steaming . . . elimination of surging and priming . . . a steady water line at all times . . . higher quality, dry steam . . . and a higher column of water above the furnace. Every point makes sense — makes performance too!

COMPACT
•
SELF-CONTAINED
•
FULLY AUTOMATIC
•
ROTARY COMBUSTION
•
UNUSUAL EFFICIENCY, SAFETY
•
GAS, HEAVY OIL, LIGHT OIL FIRING

CHECK NOW
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write for
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EC-100C.

Other types and sizes —
5 to 250 h.p.
See the Yellow Pages
in Phone Book for
Dutton Representative.

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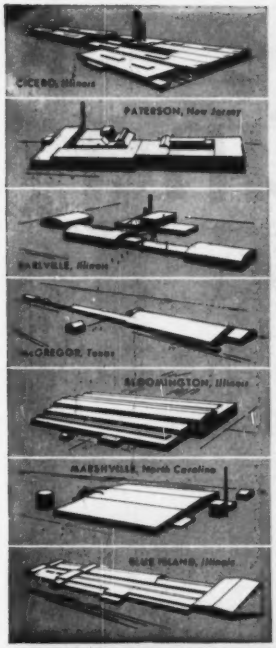
DIVISION HAPMAN-DUTTON COMPANY
KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880



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- PIPE INSULATION
  Amocel
  Unibestos No. 750
  Unibestos No. 1200
- UNIBESTOS INSULATING BLOCK
- UNARCO METAL FACED INSULATING BLANKETS
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EVER BETTER INSULATION SO THAT INDUSTRIES CAN

Save Btu's on pipes of peace or war

Whatever your insulation problem, whether it is to retain heat or cold; whether it is a conventional pipe application or a unique or complicated condition involving close quarters and the need for the most rugged construction, Unarco has a type of insulation to help you meet the problem most efficiently and economically. Unarco engineers utilize the best material for the job with many exclusive Unarco construction features that have made these insulations a standard in industry.

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This manual will quickly show you what products fit a particular specification—and vice versa . . . help you select alternates for scarce materials. It's complete! Among specifications included are Army, Navy, MIL, Federal, ASTM. Developed for the busy industrial designer, engineer, purchasing or maintenance executive or architect, you can count on it to save you hours every day, help speed production for defense. A copy is yours without obligation. Just ask your Carey Industrial Sales Engineer—or fill in coupon and mail today.

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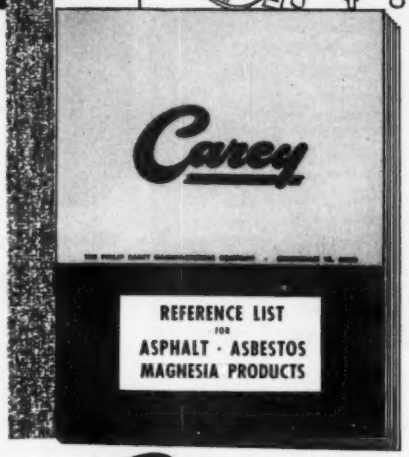
His training and experience make him your valuable ally in the solution of problems in building construction and maintenance—manufacturing and process operations. Call him in to show you how Carey products can help you get the job done, *faster*—for less!



The Philip Carey Mfg. Company
Lockland, Cincinnati 15, Ohio
Department P-1

Gentlemen: Please rush me my free copy of the Carey Reference Manual for Asphalt, Asbestos and Magnesia Products.

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Carey

The Philip Carey Mfg. Co., Lockland, Cincinnati 15, Ohio
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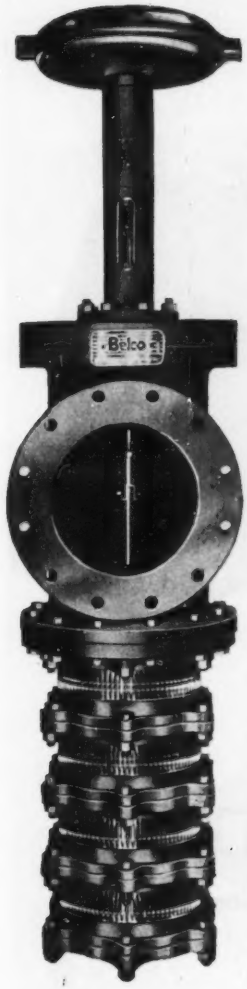
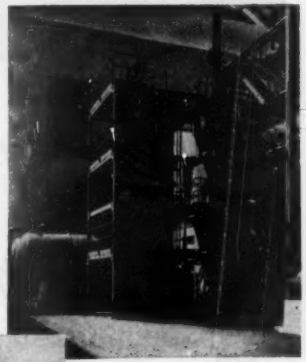
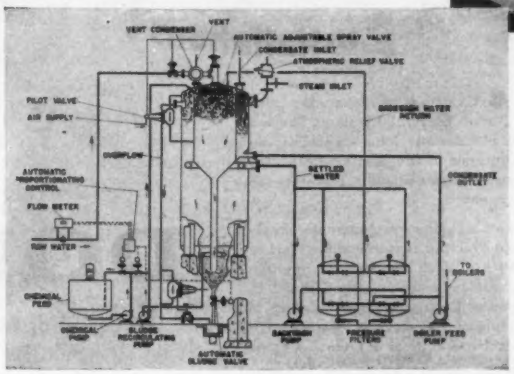
ASPHALT • ASBESTOS • MAGNESIA PRODUCTS

The exclusive Belco Automatic Atomizing Valve Performs a Superior job in HOT PROCESS SOFTENERS



Yes, the Belco Valve, by dividing influent water into finely atomized droplets insures practically instantaneous heating on contact with the steam atmosphere. Thus elimination of 95% of the dissolved oxygen and all free carbon dioxide is accomplished. Excellent results have been attained with the Belco valve and numerous installations stand as proof of its maximum efficiency. We would like to tell you more. The types of jobs we design and build—the customers we design and build for. Call us next time you consider equipment for the removal of water impurities. We're sure we can help you to your advantage.





You may be interested in Bulletin 103, it describes Belco Heaters, Deaerators & Hot Process Softeners.

Belco

Processes for Removal of Water Impurities

BELCO INDUSTRIAL EQUIPMENT DIVISION, INC.

PATERSON 3, NEW JERSEY

HEADQUARTERS FOR AUTOMATIC CONTROL OF ALL WATER CONDITIONING PROCESSES • AUTOMATIC CHEMICAL PROCESS CONTROLS • WATER SOFTENERS: Hot Lime Soda, Belcolite, Gravity and Pressure Types, Automatic and Manual • **FILTRATION EQUIPMENT:** Gravity and Pressure Filters, Automatic and Manual Filters, Siliceous and Non-Siliceous Filters, Iron, Oil, Taste, Odor and Color Removal Filters • **SWIMMING POOL PURIFICATION EQUIPMENT:** Automatic and Manual • **DIATOMACEOUS EARTH FILTERS • COAGULATION EQUIPMENT:** Slow and Rapid Mix Agitators (Adjustable variable speed) Setting Tanks, Sludge Removers • **SPECIAL EQUIPMENT:** Deionized (Equivalent to Distilled) Water Equipment, Silica Removal Equipment, Boiler Feed Water Heaters, Deaerators, Degasifiers, Chemical Dry Feeders, Chemical Pressure Feeders, Oil Separators (Refining process type)

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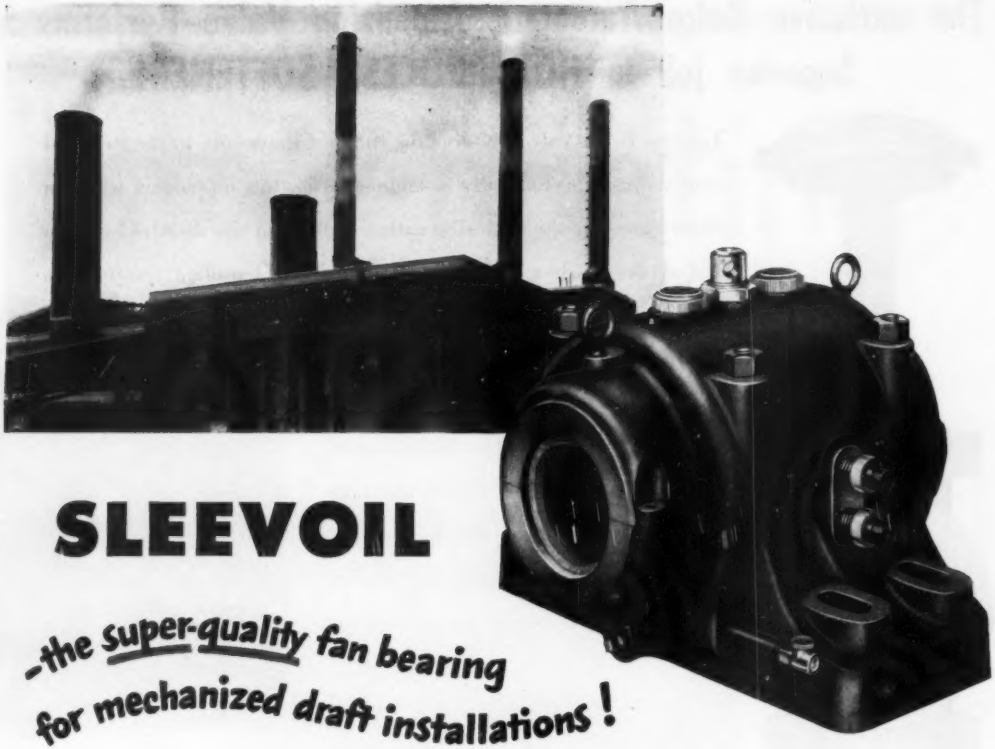

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-the super-quality fan bearing for mechanized draft installations!

Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

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of Mishawaka, Ind.

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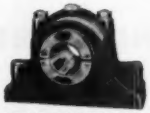
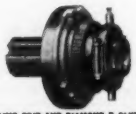


DODGE-TIMKEN PILLOW BLOCKS



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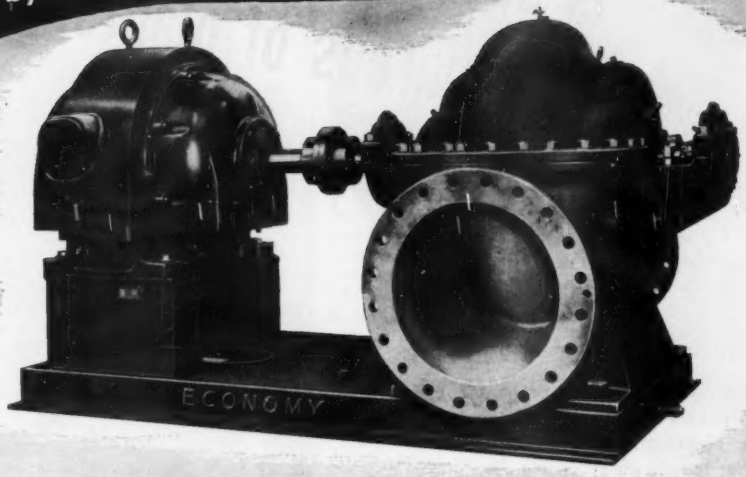
backed by over thirty years of specialized experience



The Type M Single Stage Double Suction Pump illustrated is just one of the many in the extensive line manufactured by Economy Pumps, Inc. This exceptionally rugged design is available in capacities from 50 to 30,000 gallons per minute at heads to 300 feet. A general purpose pump, it is ideally suited to general water supply or heavy mill service.

Maintenance expense is held to a minimum. Case records show Economy Pumps operating for fifteen to twenty years without replacement of major parts. However, should repairs be necessary, all parts subject to wear are renewable.

Economy Pumps are tested in accordance with the standards of the Hydraulic Institute and the A. S. M. E. under conditions duplicating as nearly as possible those encountered in actual service.

Catalog No. A750 gives complete design and construction details, also some interesting typical examples of performance, as well as handy selection tables. Write Dept. EC-1 for your copy.

Economy Pumps Inc.

Sedgley Ave. at 19th and Lehigh, Philadelphia 32, Pa.

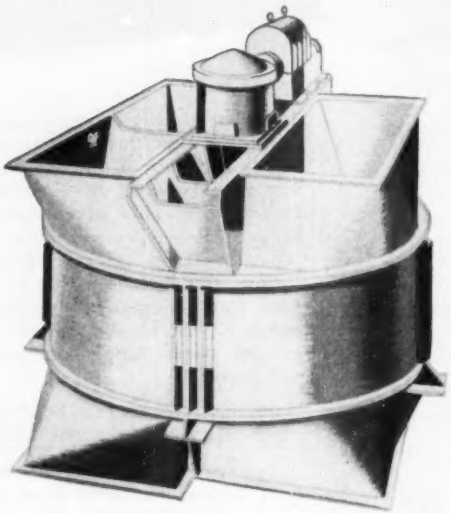
...preheater fuel costs ...s of plants!

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

Your fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom air preheater can raise the overall efficiency of *your* plant.



THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

ONLY COCHRANE ZEOLITE SOFTENERS and FILTERS have the HYDROMATIC SINGLE CONTROL VALVE

Below is shown a Hydromatic Valve arranged for automatic operation.

ONE important feature of Cochrane Zeolite Softeners and Filters is the Hydromatic Single Control Valve replacing the usual "valve nest" or rotary disc single control valves of other equipment. It has the following advantages:

1. It is pilot-operated . . . easy to operate.
2. Soft, single-seated individual valves insure drop-tightness.
3. Six positions—four normal, one shut-off, one for draining.
4. Individual valves easily accessible and replaceable.
5. Automatic and adjustable backwash and rinse controls eliminate need for concrete sumps.

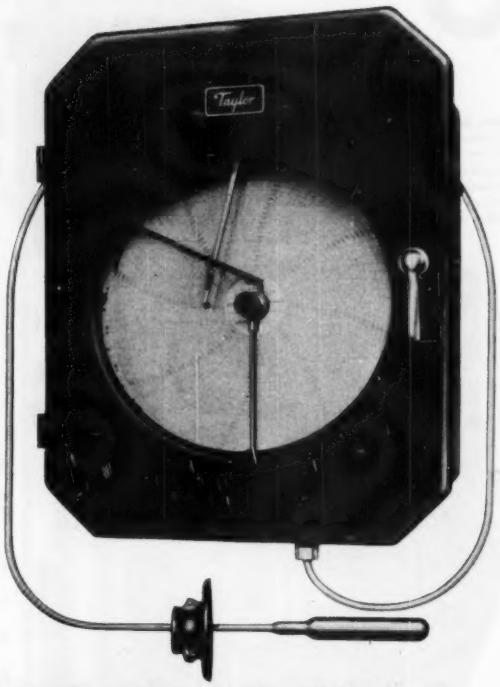
Exploded view of Hydromatic Valve with Front Distributor detached showing detail of valve.

Write for a copy of this 32-page publication (No. 4520) describing not only the Cochrane Hydromatic Single Control Valve, but also, in complete detail, a description of the Cochrane Sodium Zeolite Softener. A separate publication (No. 4530) describes Cochrane Hydrogen Zeolite Softeners. Mention which type you are interested in.

COCHRANE CORPORATION
3106 N. 17th Street, Philadelphia 32, Pa.
In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico: S. A. Mexico City
In Europe: Recuperation Thermique & Epuration: Paris

COCHRANE

Watch the "Handwriting on the wall" and you'll get



TOP EFFICIENCY!

A TAYLOR Recording Thermometer's accurate, minute by minute chart record of temperature gives you a check on efficiency of operators and equipment that no other method can beat. It helps you locate faulty or inefficient operation of equipment, by showing temperature fluctuations that you might miss by occasional reference to indicating instruments.

Taylor Recording Thermometers are available with four types of actuation . . . mercury, vapor, gas and organic liquid . . . with temperature ranges from −125 to +1000° F. or equivalent C. A selection of hundreds of charts with short or long temperature ranges, a wide variety of bulb forms, and selection of many types of connecting tubing, armored and unarmored, means you can choose the ideal instrument for any application.

Taylor Recorders come in one, two, or three pen models, for convenient records on operations involving two or three related temperatures. In operating a condenser, for example, a three pen recorder will keep a record of steam inlet, condensate, and circulating-water temperatures, all on one easy to read chart. Combination temperature and pressure recording models are available too.

Regardless of what your temperature measuring problem is, ask your Taylor Field Engineer, or write for **Catalog 761.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed density, load and humidity.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

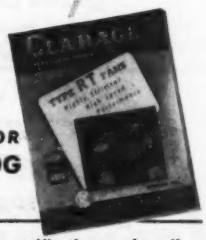
BATTLESHIP CONSTRUCTION
Built above and beyond the demands of average service. Photo shows fan with section of housing removed.

These HEAVY-DUTY FANS

Now Operating in 43 States and 15 Foreign Countries

Wide popularity—and deserved! Clarage Type RT Fans bring efficient performance and tremendous endurance to your **most exacting** jobs—induced draft, forced draft, and furnishing air for industrial processes . . . pressures to 38.6 inches (standard air); temperatures to 1000 deg. F.; capacities to 300,000 c. f. m.

Here is **HEAVY-DUTY fan equipment** which carries the endorsement of consulting engineers, plant engineers and boiler manufacturers. Install RT Fans and your first cost is the last—for a **long time** to come. Call us in for specific recommendations!



WRITE FOR CATALOG 901

Applications, specifications and available arrangements all covered in catalog. Send for your copy today.

YOU CAN RELY ON

CLARAGE

HEADQUARTERS FOR AIR HANDLING & CONDITIONING EQUIPMENT

Clarage Fan Company 615 PORTER STREET **KALAMAZOO, MICH.**

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Every Top Management Man... In Every Industry

SHOULD BE ABLE TO ANSWER THESE QUESTIONS ABOUT A MOST CRITICAL EMERGENCY IN OUR COUNTRY'S AFFAIRS

Q. Why is iron and steel *scrap* a matter of importance to me?

A. Steel for our country's military program and civilian economy is being produced at the annual rate of 107,000,000 tons in 1951 . . . 119,500,000 tons expected in 1952. Steel-making capacity is being increased now to meet those quotas.

What Do I Get For My Scrap?

In addition to being paid for your scrap, you remove nuisance inventory from your plant—saving valuable floor space. Also, you have a better chance of *getting* new steel or steel products. But, *most important*—you help alleviate a dangerous condition threatening our country's capacity to rearm and satisfy civilian requirements at the same time.

Q. How does scrap figure in the production of steel?

A. Steel is composed, generally speaking, 50% of pig iron, 25% of "production" scrap (that is, the scrap which is produced as a by-product of steel-making) and 25% of "purchased" scrap.

Q. Is scrap getting scarce?

A. Yes. The supply of *purchased* scrap is not increasing fast enough to meet the needs of increasing steel production.

Q. What if the needed scrap isn't obtained?

A. Open-hearth furnaces will not be able to operate at capacity. That will mean a loss of steel production . . . and fewer products made of steel.

Q. Why not use pig iron instead of scrap?

A. Every ton of scrap conserves approximately 2 tons of iron ore, 1 ton of coal, nearly ½ ton of limestone and many other vital natural resources—to say nothing of the extra transportation facilities that would be otherwise required.

Q. How can *more* scrap be furnished?

A. By everybody pitching in—as we always do in every emergency—and searching out all possible sources of scrap.

Q. What are these sources?

A. Metal-fabricating plants normally turn over to scrap dealers the scrap left from machining. But there's not enough of this to fill our present enormous need. So everybody—both in and out of the metal-fabricating industries—must sell scrap in the form of *idle metal*.

Every pound of idle metal is needed to keep our steel mills operating at top capacity. Sell your idle metal to a local scrap dealer right away.

What Do I Do *First*?

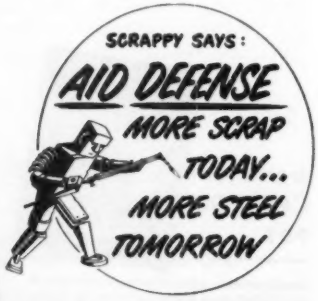
Write for free booklet. It tells how to set up a Scrap Salvage Program in your plant. Thousands of plants are cooperating. Do your part now! Address Advertising Council, 25 West 45th Street, New York 19, N. Y.

Q. *We* don't *produce* scrap—how can *we* help?

A. Scrap is any kind of iron and steel that's gathering dust—obsolete machines or structures, jigs and fixtures, pulleys and wheels, chains and track, valves and pipe—*anything* with rust on it or dust on it. Non-ferrous scrap is needed, too.

Q. What do we do with it when we find it?

A. Use your normal channels or get in touch with a recognized scrap dealer.

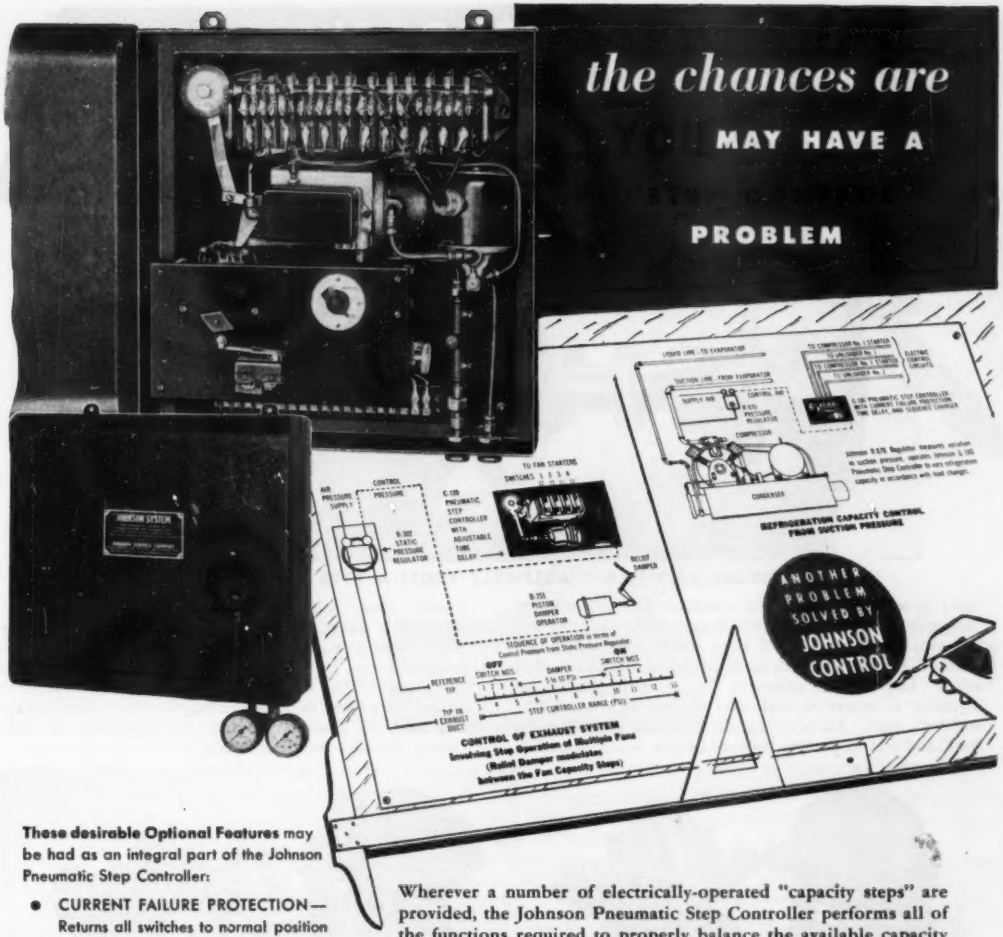


This advertisement is a contribution, in the national interest, by

McGRAW-HILL PUBLISHING COMPANY, INC.

330 WEST 42nd STREET NEW YORK 18, N. Y.

A PUBLIC SERVICE PROJECT THE ADVERTISING COUNCIL



These desirable Optional Features may be had as an integral part of the Johnson Pneumatic Step Controller:

- CURRENT FAILURE PROTECTION—Returns all switches to normal position in less than one second.
- TIME DELAY MECHANISM—Provides adjustment, to any desired period up to 12 minutes, of the time required to operate all switches. Then, on current failure or at "start-up", the predetermined time interval must elapse between the individual steps of control.
- AUTOMATIC or MANUAL SEQUENCE CHANGER—Varies the succession of the steps of control in order to equalize the wear on equipment.

Wherever a number of electrically-operated "capacity steps" are provided, the Johnson Pneumatic Step Controller performs all of the functions required to properly balance the available capacity and the load. This unique, single unit, operated by a Johnson pneumatic temperature, humidity or pressure regulator, actuates separately adjustable, single-pole, double-throw switches in any desired sequence. It is available in 4, 6, 8 and 12-switch models and eliminates the disadvantages of a series of separate pressure switches. Such difficulties as providing sufficient space, maintaining separate delicate mechanisms, adjusting and retaining adjustment are completely avoided.

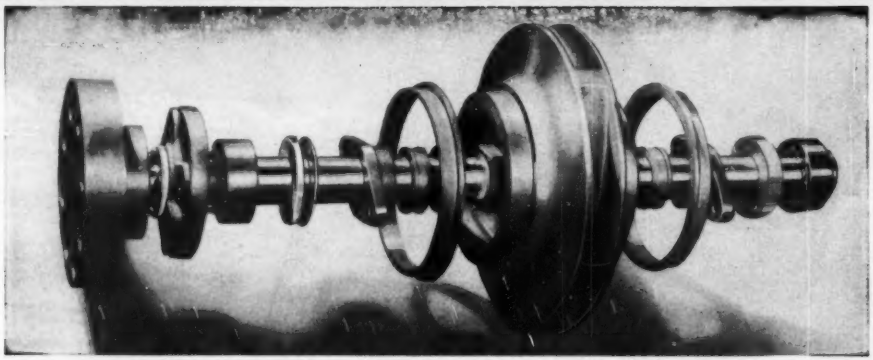
Yes! The CHANCES ARE that the Johnson Pneumatic Step Controller will solve your sequence control problems. Ask a nearby Johnson engineer to discuss the application of this interesting device. Bulletin G-180 presents the essential features. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

Automatic Temperature and Air Conditioning

JOHNSON CONTROL

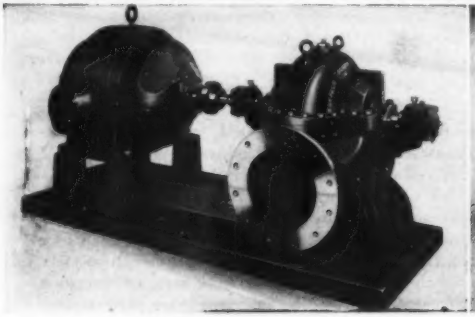
MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

"INSIDE STORY" on "Buffalo" PUMPING EFFICIENCY!

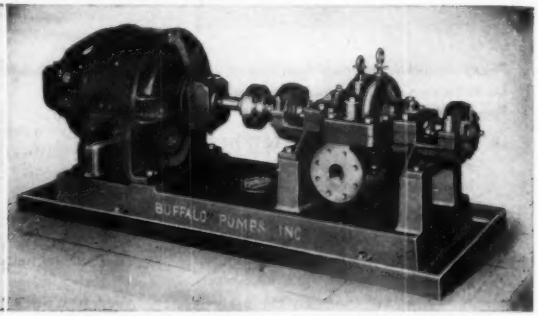


ROTOR AND SHAFT ASSEMBLY FROM A TYPE "SL" PUMP

Here is strength, precision construction and efficient design in the "business department" of the pump! Note the oversize shaft. It's of high grade steel, machined all over, bronze covered, or solid monel metal or other alloy. Impeller is mounted on an enlargement of diameter at center of shaft and secured by feather key and lock nuts. All rotating elements are assembled on shaft and put in perfect balance before being placed in pump. And, just as important, the impeller is hydraulically balanced—always receiving water from opposite sides in equal volume and pressure. Efficiency is increased, too, by the simply formed water passages in the pump casing of all "SL" Pumps. It's just another reason why there is no better buy in clear water pumping than a "Buffalo" Pump—for long life, for efficiency, for all-around economy.



"Buffalo" Double Suction Ball Bearing Pump, Type "CS", which is supplied with the shaft assembly shown above. For capacities from 10 to 10,000 gpm, clear water. WRITE FOR BULLETIN 955-N.



"Buffalo" Type "RR" Single Suction Pump, also used for clear water service, for high pressures, any temperature . . . in applications such as boiler feed. In 2- and 4-stage models. WRITE FOR BULLETIN 980-C.

"Buffalo" PUMPS

BUFFALO PUMPS INC.

488 BROADWAY BUFFALO, NEW YORK

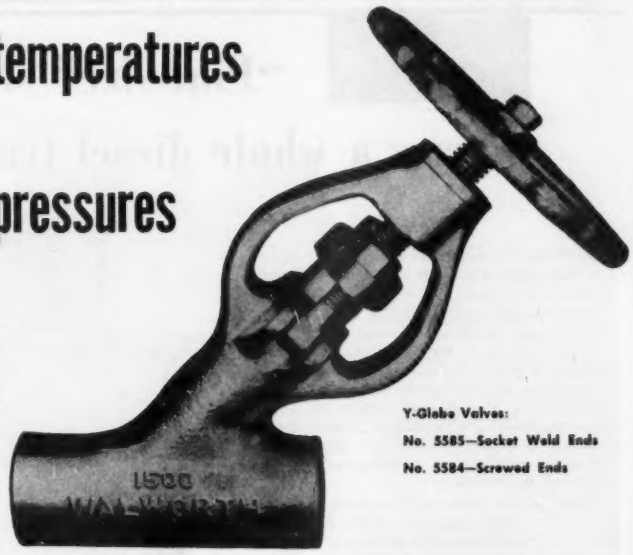
Canada Pumps Ltd., Kitchener, Ont. Branch Offices in All Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Walworth's NEW small cast steel valves

SERIES 1500 – SIZES ¼ to 2 inches

handle HIGH temperatures
HIGH pressures



Y-Globe Valves:
No. 5585—Socket Weld Ends
No. 5584—Screwed Ends

Walworth is proud to make these new Small Cast Steel Valves available to power stations . . . oil refineries . . . ships . . . wherever piping is subject to severe pressures and temperatures. Non-shock service ratings of these valves: 1500 psi–950F for steam; 3600 psi–100F for water, oil or gas. Cast of chromium molybdenum steel, they are compact and light, yet exceptionally strong. Both Y-Globe and Angle type valves are available.

Simplified Walworth design eliminates many of the valve problems encountered in high pressure service. Among the features of this new valve are:

INTEGRAL BODY AND YOKE – made from a single casting without threading or welding. Bonnet joint — always a potential source of leakage — is eliminated. Valves can be reassembled quickly and easily.

ROTATING DISC – prevents valve seat distortion and consequent leakage. Cuts down replacements.

WELDED SEAT RING – compensates for changes in pressure and temperature—eliminates a major source of leakage.

SPECIAL BACK SEAT BUSHING – permits repacking the valve under pressure with greater safety.

PACKING CHAMBER – designed to dissipate heat thus keeping packing rings at lower temperatures—gives them longer life.

These valves are available with either socket weld ends or screwed ends, in sizes ranging from ¼ to 2 inches. For further information on Walworth series 1500 Small Cast Steel Valves, see your local Walworth distributor, or write for Circular No. 134.

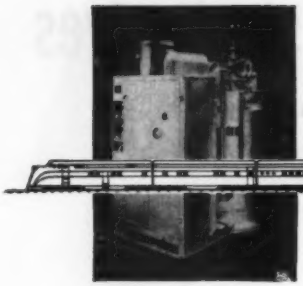
Angle Valves:
No. 5587—
Socket Weld End
No. 5586—
Screwed End

WALWORTH

valves • fittings • pipe wrenches

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



"Pint-size" steam generator warms a whole diesel train

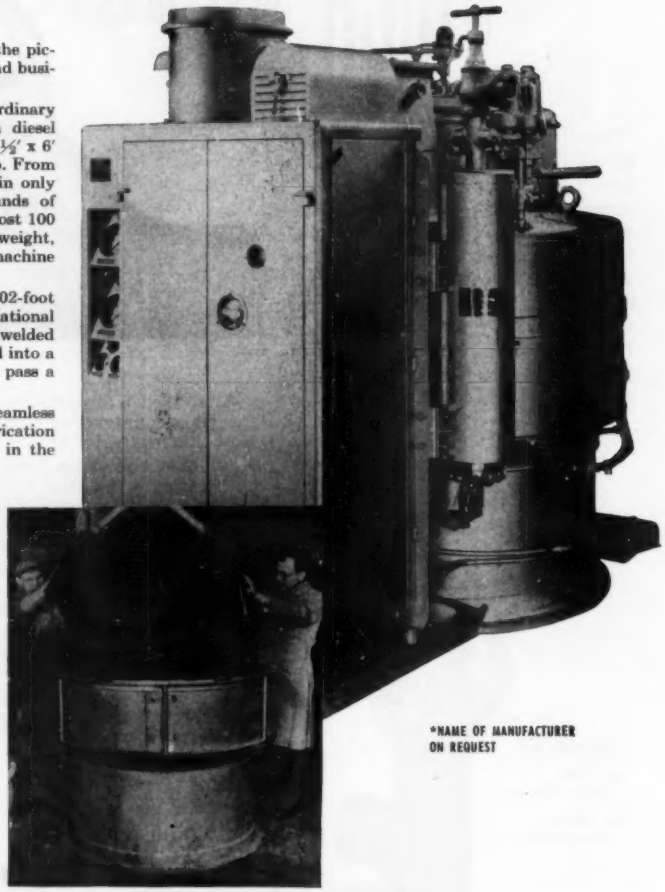
That Vapor-Clarkson steam generator* in the picture has caused a real stir both in the railroad business and out of it.

Even though it's no bigger than an ordinary clothes closet, it does the one big job a diesel locomotive can't do by itself—this 3½' x 5½' x 6' generator can heat an entire train. Fast, too. From a cold start, it will deliver 200 pai steam in only two minutes. Capacity is over 4500 pounds of steam per hour. That's enough to heat almost 100 homes in dead zero weather. For size and weight, this is the most powerful steam-making machine developed by industry.

Heart of this ingenious generator is a 702-foot long set of continuous coils made from National Seamless Steel Tubing. Standard lengths are welded into 200 or 300 foot lengths, then cold rolled into a coil. All coils are interchangeable. All coils pass a 1200 pound hydrostatic pressure test.

This is another instance of National Seamless doing a fine job, despite the exacting fabrication methods and rigorous tests. The reason is in the tubing itself—in that magic word, "Seamless." There aren't any longitudinal welds to weaken the tube. Each tube is pierced from a solid billet of steel . . . the *one* method that removes all doubt concerning wall strength.

When planning the use of seamless pipe or tubing for future needs, be sure to specify National Seamless, made by the world's largest and most experienced manufacturer of tubular steel products.



*NAME OF MANUFACTURER ON REQUEST

NATIONAL TUBE DIVISION

UNITED STATES STEEL COMPANY, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL

WANTED

The most efficient equipment to make 66,000 gph of Lake Michigan water suitable for high quality feedwater to boilers operating at 900 psi at the Whiting, Indiana plant of the Carbide and Carbon Chemicals Company, a division of Union Carbide and Carbon Corp.

THE ANSWER...

A Graver Hot Process Softener System

The Graver System was selected by the Company's consulting engineer for these outstanding advantages... the *modern economical design* of Graver equipment... its *low operating cost* ... its *proven performance* for more than 40 years... and *single responsibility* because of Graver's ability to furnish *all* required equipment, fabricated in its own plants.

THE RESULTS OBTAINED:

TOTAL HARDNESS: ...reduced to less than 1 ppm

SILICA: ...reduced to less than 1 ppm

If you have a water problem, write to Graver for authoritative recommendations.

GRAVER

EQUIPMENT IN THIS PLANT

- 2—33,000 gph Type S Hot Process Softeners with internal vent condensers and chemical feeders.
- 1—66,000 gph second-stage phosphate softener.
- 2—500,000 lb per hr stainless steel-clad Tray-Type Deaerating Heaters.
- 4—8 ft x 4 ft Anthracite Filters.
- 2—wash water tanks for filter backwashing.
- Acid Feeding system to reduce pH.
- All accessories.

GRAVER

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14th STREET, NEW YORK 11, N. Y.

GW-498

It's time we got *working* mad!

As we listen to the latest insults from Moscow, we're likely to get fighting mad.

Instead, we'd better use our heads and get *working* mad.

It is clear by now that Stalin and his gang respect just one thing—strength. Behind the Iron Curtain they've been building a huge fighting machine while we were reducing ours. Now we must rebuild our defenses—*fast.*

As things stand today, there is just *one* way to prevent World War III. That is to re-arm—to become strong—and to stay that way!

This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

THE BETTER WE PRODUCE THE STRONGER WE GROW

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL

FOR A FREE COPY OF "THE MIRACLE OF AMERICA"

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Name .....

Address .....

McGRAW-HILL PUBLISHING COMPANY

PENBERTHY Liquid Level Gages

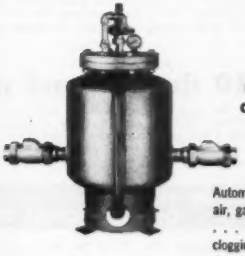
YOU CAN *Remove and Replace Without Shutdown*

Union connections between the gage and the valves permit removal of gage for repairs without shutting down the equipment. Just close the valves, uncouple the unions and remove the gage. The convenience of this is obvious. When glasses have to be replaced or repairs made, it is not necessary to work in an awkward position or to shut down. Another advantage: a gage needing repairs can be replaced immediately by a spare and the repairs made at leisure. There are many other reasons for the superiority of Penberthy Liquid Level Gages; ask for Catalog 35.

OTHER PENBERTHY PRODUCTS

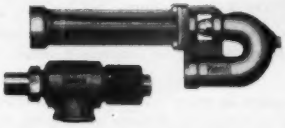
PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction —liquid chamber machined from solid block of metal. Ask for Catalog 35.



PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

PENBERTHY EXPLOSION-PROOF SUMP PUMPS

Motor and switch totally enclosed. Underwriter approved for Class I, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

4672

PENBERTHY INJECTOR COMPANY

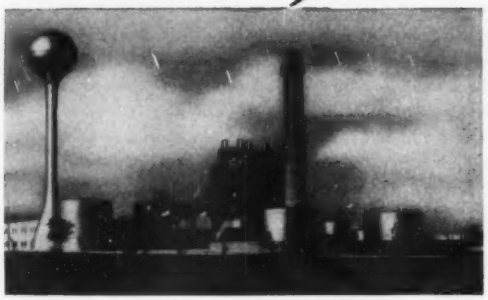
DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

QUIET

POWER PLANTS MAKE GOOD NEIGHBORS



● **Progressive power plants everywhere, recognizing that public relations and customer relations are one and the same thing, are silencing their operations with INDUSTRIAL SOUND CONTROL installations.**

ROAR of induced draft or forced draft fans, which annoys residents over a wide radius can be suppressed simply and easily by ISC.

HUM of transformers in quiet residential neighborhoods can be a nuisance at a surprising distance on a quiet night.

CRASH of machinery can permanently injure hearing of employees, damage employee relations—and cause damage suits.

INDUSTRIAL SOUND CONTROL, INC., was the originator of industrial soundproofing. Its installations, from cells for testing the most powerful jet engines to soundproofing a small compressor, have been job-proven over the years.

Don't wait until you are threatened with legal action — CALL ON ISC FIRST. Write today for full information.

Mid-Western distributor:
Midwest Industrial Sound Control, Inc.
1455 North Pennsylvania Street
Indianapolis 2, Indiana

Industrial Sound Control, Inc.
45 GRANBY STREET HARTFORD, CONN.
7119 SEPULVEDA BLVD. LOS ANGELES, CALIF.

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thoroughgoing and growing knowledge of the business they are in.

It works in the newer plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studyng sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

The Library of POWER PLANT PRACTICE

6 volumes, 2,477 pages, 2,404 illustrations

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day—more money in your pocket.

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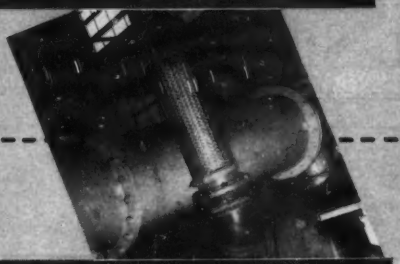

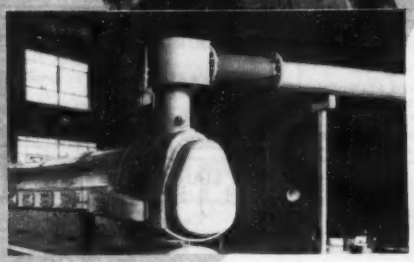

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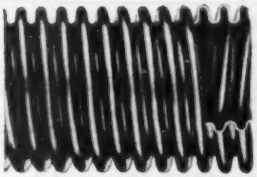

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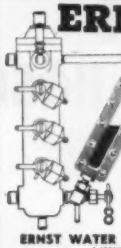

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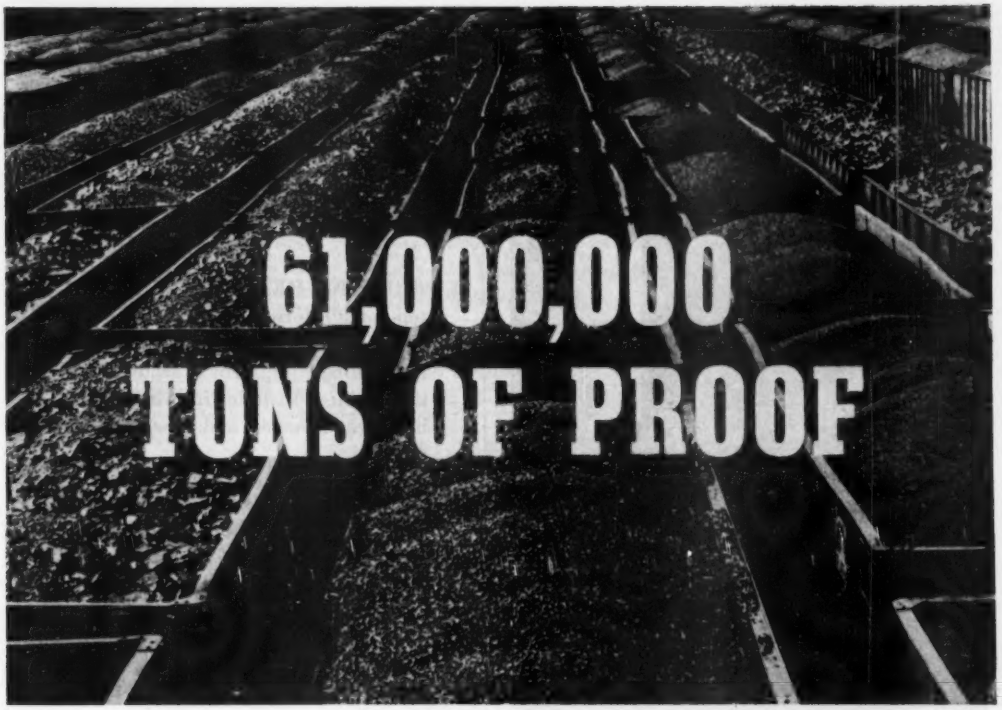

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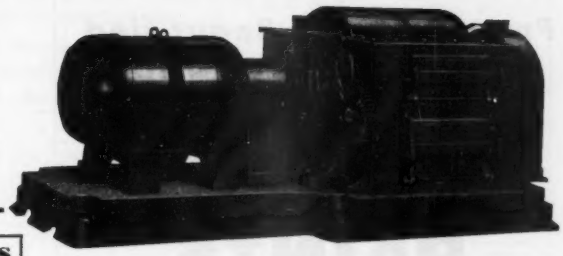

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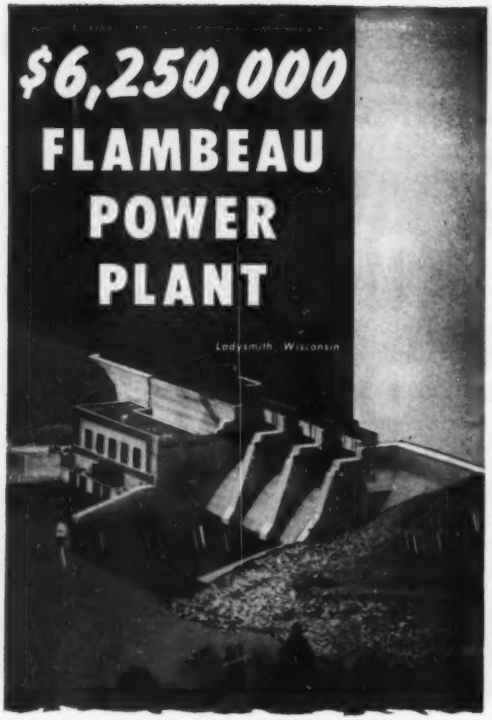

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THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED 44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500	600	6600/11800
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2300/4400
1	1000	G.E.	720	600	2300/4600
1	1000	G.E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
2	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	400	G.E.	900	275	2300/4150
1	350	G.E.	900	125	2300/4150
1	240	G.E.	1200	250	2300
1	300	A.C.	1200	240	2300
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G.E.	1200	125	440
1	100	G.E.	1170	125	220
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
6	70	G.E.	1200	70	220/440

*25 Cycle

ROTARY CONVERTERS

60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60-Exc. & Surface Cond.
1	2500	G.E.	Auto. Ext. Cond. 800 lbs.-800* F.T.T. 175/200 Auto. Ext. 2300/3/60 Exciter & Surface Cond.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
2	750	G.E.	Condensing 425#-725°TT ISP-440 V. 3 ph. 60 cy New—1944
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—2/60/480 volts direct connected exciter
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
1	400	Whse.	Non-condensing 125/150# ISP 5/10# G.B.P. 240/480v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D.C.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.

400 KW MADE UP MG SET
CAN MAKE UP SIMILAR SET

D. C. MOTORS

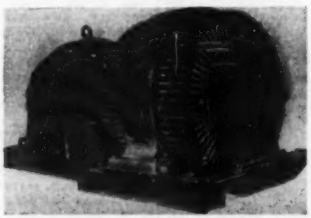
Qu.	KW	Make	Type	Volts	Speed
1—	2200	G.E.	MCF	600	360/500
1—	1750	West.		600	525/720
1—	1500	Whse.		525	600
1—	940	Whse.	QM-B. Brg.	250	140/170
1—	800/1000	Whse.		450	600/720
1—	600	Al. Ch.	MILL	230	400/800
2—	450	Whse.		550	415
1—	300/400	G.E.	DYNA	250	1335/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1—	200/300	G.E.	MPC	230	360/920
1—	250	G.E.	MPC	230	400/500
1—	150	G.E.		600	250/750
10—	150	Cr. Wh.	83H	230	890
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	380/950
1—	50/120	G.E.	MFC	230	250/1000
2—	100	Whse.	SK-181	230	450/1000
4—	75	G.E.	TLC-50	250	850/2500

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—	3000	G.E.	25/60	4000/2300x2300/4000
1—	1000	G.E.	25/58	4400/2300
1—	500	A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed
1	5000	Whse.	2400/4800	600



500 KW MG SET
IN STOCK

TRANSFORMERS

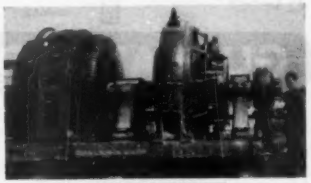
60 Cycles

Qu.	KVA	Make	Type	Ph.	Voltages
1	3000	Pitts.	OISC	3	13200x4600/2300
1	1250	Whse.	OISC	3	13200x525/460
3	1000	G.E.	H	1	2300x480
1	1000	Pitts.	OISC	1	2200x13200/2200
3	1250	G.E.	H	1	4600x550
1	500	Whse.	OISC	1	34650x432
1	500	Whse.	OISC	3	12400x216
3	500	Al. Ch.	OISC	1	13200x2300/575
3	333	Whse.	OISC	1	44000/22000x2300
2	200	Whse.	OISC	1	44000/22000x2300
9	300	G.E.	HT	3	2400x240/460
3	150	Whse.	OISC	1	34500x220/440
3	100	G.E.	OISC	1	2400x120/240

RECTIFIERS

Qu.	KW	Make	Type	Volts	Speed
1—	750	G.E.	BHW	575	2300
1—	1000	A.C.	R-612	625	13500
1—	1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.



2000 KW—MG SET
IN STOCK

A. C. MOTORS

3 ph. 60 Cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
2—3000	Whse.		2300	120
2— 900	Al. Ch.	(New)	2200	150
2— 735	G.E.	ATI	1200/11000	600
1— 650	Whse.	G	2300	138
1— 500	G.E.	TS 7657	2400/4800	600
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2300	250
1— 300	Whse.		2300	720
1— 100	Whse.		550	600
1— 100	F.M.		220	1200
1— 100	E.M.		440	600
1— 85	G.E.	TS	440	1800

SLIP RING

1— 500	Whse.	CW	550	350
2— 500	G.E. unused	M-574Y	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
1— 500	G.E.	IM	440	900
1— 350	G.E.	MT442-Y	2200/4000	253
1— 300	Al. Ch.	2 Brg.	2300	505
4— 300	G.E.	ITC-5017	550	585
1— 300	Al. Chal.	ANY	2200	705
1— 250	G.E.	MT-434Y	4000	257
1— 250	G.E.	MT-559B	2200	1750
1— 200	G.E.	MTP	440	1170
3— 200	G.E.	IM-17	440	580
1— 150 new	Whse.	CW	2300	450
4— 125	G.E.	MT-566Y	440/2200	435
1— 100	G.E.	IM-16	2200	435
2— 100	G.E.	IM	440	600
3— 100	Al. Ch.	ANY	440	892
1— 100	G.E.	MT556	2200	900
1— 75	Whse.	CW-761	2200	1725

SQUIRREL CAGE

2— 650	G.E.	FT559BY	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 300	G.E.	KT-574Y	2300	505
1— 200	G.E.	IK-17	440	580
1— 200	G.E.	KT557	440	1800
1— 200	G.E.	IK	440	885
1— 150	Wstghse.	CH856B	440	880
1— 125	Whse.	MS	440	485
1— 125	G.E.	KF-TEFC	440	2583
9— 125	Al. Ch.	ARW	2200	1750
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-513	220/440	1750

*American Rebuilders Association — Member Body of A.S.A.

BELYEA COMPANY, INC.

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43 HOWELL ST., JERSEY CITY 6, N. J.

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N. Y. CITY LINE
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here's the reason...

...YOU CAN FIND EQUIPMENT YOU NEED—

LARGE STOCKS - ON - HAND

Our modern plant houses one of the nation's largest stocks of motors and equipment. Here you will find row upon row of motors, rebuilt and ready for use to meet your requirements. From this complete stock you can be sure that you will find what you need and that it is quality equipment fully guaranteed.

GUARANTEED REBUILT POWER EQUIPMENT

HERE'S A PARTIAL LISTING OF OUR HALF-MILLION DOLLAR STOCK

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
1000	*G.E. (New)	K6347S	1800
750	*G.E.	KT	720
550	*G.E.	KF-559	3600
500	*G.E.	PBG	1800
500	*Fr-Morse	HS	1200
450	*G.E.	KF-567S	1200
400	*Cont. (New)	NZ	1800
400	*A.C.	ARWW	900
400	*G.E.	1K	514
350	*Cr.-Wh.	SC	3600
300	*West.	CS	3600
300	G.E.	IE-K	1200
300	A.C.	AR	900
300	West.	CS	514
250	West. (New)	CS	1800
250	*L.-Allis	OGX-148S	720
250	West.	CS	600
200	*G.E.	IK-13B	1800
200	*G.E.	1K	514
150	G.E.	KT-546	1800
150	G.E.	IE	1800
150	G.E.	KTP	1200
150	West.	CS950A	600
125	West. (New)	CS504	3600
125	*A.C.	AR-326	1800
125	G.E.	K6328S (TEFC)	1200
125	A.C. (New)	AW	1200
125	G.E. (New)	K6333	900
100	A.C. (New)	ARWWT	3600
100	*G.E.	FT542Z	1800
100	G.E.	FTRP	1800
100	*West.	CS	1800
100	A.C. (New)	AW	1200
100	Rel. (New)	AAC (TEFC)	1200
100	U.S. (Vert.)	GFU	1200
100	G.E.	KT558S	720
75	West. (New)	CS508S	1800
75	Triumph	TR16	514
75	G.E.	IK	600

Hundreds of Smaller Motors

HI-PRESSURE PUMPS

GPM	Make	Type	Head
800	Worth.	6DS	925 Ft.
500	Manintee	H	250 Ft.
300	Al.-Ch.	NMZ	300 Ft.

AIR COMPRESSORS

Size	Make	Type	Displ.	Press
9 x 9	Worth.	HB	211	100
9 x 8	Ing. R.	ER1	145	100
8½ x 9	Worth.	HB	170	100
7 x 7	Worth.	HB	122	100

ROTARY CONVERTER

1000 KW Westinghouse, 900 RPM, 600 V DC, 4708/4280 V AC, 6 Ph. 60 cy. with complete starting equipment.

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Cr-Wh.		240
800	*A.C.	3 Brg.	450
650	West.	HE	350
500	*G.E.	IM17B	900
500	West.	CW	350
400	A.C.	3 Brg.	450
400	*G.E.	MT-412	450
300	*G.E.	IM-15	1800
300	*G.E.	MT-410	450
250	*G.E.	MT-422	300
200	G.E.	IM	1800
200	*G.E.	IM-16	600
150	*G.E.	IM-16	600
125	*G.E.	MT-549	1800
125	G.E. (New)	M6333	900
125	G.E. (New)	M6334	720
100	A.C.	ANY	900
100	West.	CW	600
100	G.E.	IM	450
75	*A.C.		900
75	Star	OS00	900
75	G.E.	IM-14	600
60	G.E. (New)	M505	1200
60	West.	CW	900
50	G.E.	IM11A	1800
50	A.C.	ARY	1800
50	West.	CW	1200
50	G.E.	MT346	720
50	G.E.	IM	600
50	G.E.	IM14	425
40	G.E.	MT336	1200
40	West.	CW644	900
40	G.E. (New)	M504U	900
35	Fr-Morse (Vert.)	UAB	1800
35	G.E.	IM	1200
30	West.	CW445	900
25	A.C.	ARY220	900
20	G.E.	IM	720
15	L. Allis (New)	OH326	1800

D. C. MOTORS

230 Volts

H.P.	Make	Type	Speed
1000	Westgh. (600 V)		400/800
400	Westgh.		600/1200
375	Westgh.	Ped	650
200	Westgh.	SK210	800
175	Reliance	1400T	675
175	G.E.	ELC11	750
125	G.E.	Marine	1200
100	G.E.	RC34	2500
100	Westgh.	SK173	850
100	A.C.	E152	575
40	Cr.-Wh.	CMC	1750
40	G.E.	CO2004	600
35	Cr.-Wh.	CM351	700
35	G.E.	C	600
30	Westgh.	SK120	975
30	Cr.-Wh.	CCM	450
30	Westgh.	SK933	1750
30	G.E.	RC31B	1150
25	Westgh.	SK113	850
25	Westgh.	SK100L	1100

MANY OTHERS—1 HP and Up! ALSO 115 VOLT

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

*H.P.	Make	Type	P.F.	Spd.
1420	*Westgh.	Syn.	.7	900
800	G.E.	TS984	1.0	1800
750	*Westgh.		.8	900
700	G.E.	TS		514
320	*Al.-Ch.	Dr. Pf.	1.0	720
300	Cr.-Wh.	Eng.	1.0	300
300	G.E.	ATI-8	.8	900
250	*Al.-Ch.	Dr. Pf.	1.0	720
220	G.E.	ATI	1.0	600
190	El. Machy.	Ped.	1.0	450
150	El. Machy.	EM	.8	720
150	*Westgh.		1.0	300
125	Parkinson			900
125	El. Mach.	Syn.	1.0	900
125	Cr.-Wh.	103-S	1.0	900
125	*G.E.	TS	1.0	277
115	E.-M.	EM	1.0	240
100	Cr.-Wh.	103S	.8	900
100	G.E.	ATB	.8	900
100	Ideal	SMS	1.0	900
75	G.E.	ATI	1.0	900
60	G.E.	TS7536	1.0	1200
40	G.E.	ATB	.8	1200
20	Fynn W.	15VRN		1200
15	Century	ARC365	1.0	1200
4	G.E.	AK (25 cy.)		1500

D. C. MOTORS

ADJUSTABLE SPEED

230 Volts (*115 Volt)

H.	Make	Type	Speed
30	G.E.	C	300/900
20	West.	SA-8	500/1800
20	West.	SK-110L	500/1800
20	A.C.	ER-145	300/1200
15	*Triumph	Planer	225/900
12.5/15	G.E.	RC-116	500/1500
10/15	Reliance	185T	400/1600
10	*Elec-D	7½S	300/1200
10	G.E.	RF-11A	300/1200
10	G.E.	RD-10A	500/1800
10	West.	SK-100	400/1600
10	G.E.	CR-10	450/1350

AC SYNCHRONOUS GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

K.V.A.	Make	Type	P.F.	Spd.
1500	G.E.	ATI	.8	900
1000	*West.	203D	.8	900
250	*Al. Ch. (new)		.8	720
150	El. Mach.	EM	.8	720
112.5	*G.E.	ATB	.8	1200
110	Cr. Wh.	103	.8	900
100	*G.E.	ATB	.8	900
60	Fr.-Morse	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200

DIESEL-GENERATORS (2)

NEW—81.25 KVA Rogers AC Generators, 3/60/120/208, d/c Exciter Driven by direct-connected Cummins Diesel Engine, Model H-1 Complete Control Panel—NEW.

1000 KW M.G. SET

3-UNIT

2—500 KW West. DC Gens., 275/137.5 V, 3 wire, 1820 Amps.

D/C TO

1420 HP West. Syn. Motor, 900 RPM 11,000 V. 60 Cy., 3 ph. 3 Brg. on Castiron Factory Base.

M. G. SETS

K.W.	Make	A.C.	D.C.
1000	G.E. (3 U)	11,000	137/275
500	Westgh.	2300	250
500	Westgh.	550	250
500	Cr.-Wh.	220-440	250
450	G.E. (3 Unit)	2300	125/250
400	Westg.	2300	600
250	Westg.-G.E.	440	250
200	Cr.-Wh.	440	250
200	Ridgeway	2200	250
150	G.E.	2300/440	250
150	G.E.	440	250/275
150	Cr.-Wh.	440	250
150	Al.-Ch.	220	125
100	G.E.	440	250
100	G.E.	220	250
100	G.E. Delco	440	120/240
75	Al.-Ch.	440	250
75	Westg.	2300	110
60	Al.-Ch.	2300	110
40	Cr.-Wh.	220	125
40	Elec. P. G.E.	440	250
40	Al.-Ch.	440	250
30	Cr.-Wh.	220	125
25	G.E.	440	250
20	G.E.	440	250
10	G.E.	440	125
10	Cr.-Wh.	220	125
10	G.E.	440	250

D. C. to A. C.

100	G.E.	230	250

TRANSFORMERS

2—2000 KVA Pittsburgh, 1 Phase 12,000 V to 2300 V.
1—750 KVA Westinghouse, AIR—3 Phase, 13800 V to 480 V.
1—750 KVA Westinghouse—AIR—3 Phase 13,800 V to 2300/4160 V.
3—667 KVA Ningara, 1 Phase 13,000 V. to 480 V.
3—300 KVA General Electric, 3 Ph. 13800 V. to 240/480 V.
3—300 KVA Allis-Chalmers (new), 1 phase 2400/416-Y V. to 120/240 V.

First Source for 41 Years for Quality Electrical Equipment

CHICAGO Electric Co.

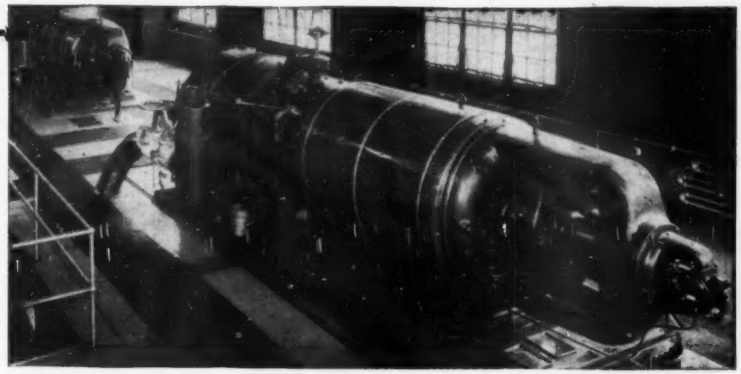
1320 W. CERMAK RD. • CHICAGO 8, ILLINOIS

2500 KW. @ .80. 3125-KVA.

TWO (2) GENERAL ELECTRIC TURBO-GENERATORS

VERY HIGH GRADE UNITS: Are Duplicates

WILL PASS RIGID INSPECTION



Above View shows our Two (2) General Electric Turbo-Generators on present Foundations. They are 2500 KW @ 80% PF, 3125 KVA, both are complete units with (2) Surface Condensers, Exciters, and all auxiliaries. Steam 160/225# psig, 450° FTT, 2300, 4160, 6900 V.

FREE BULLETIN #900 in Colors has specifications and Complete Data on above Units. SEND FOR IT TODAY.

A PARTIAL LIST OF TURBO-GENERATORS IN OUR STOCK IS GIVEN BELOW

12,500-KVA G.E., CONDENSING Complete A-1

6,250-KVA G.E., Complete Condensing Unit Condition: Excellent, 200# PSIG, 2300/4160 V. High Grade Unit

3,750-KVA G.E. 150/250# PSIG, 480 Volt Limited use since Rebuilt A-1

3,750-KVA G.E. modern 440# PSIG, 750° FTT 2300 Volt, Rare unit

3,125-KVA 160/225# psig, 2300 Volt
See above Cut and description (2)

3,125-KVA G.E. 200# psig, 2300 V. OK

2,500-KVA G.E. 150/200# psig, 2300 V

2,500-KVA, Westg. 250/350# psig, 2300 Volt, Non-cond. Like New Unit. Back P. 40/50#. Modern. Any Insp.

1,875-KVA Allis-C, 150-200# psig 2300 V. Rebuilt by Allis Co.

1,875-KVA Allis-C, 150/250# psig 2300 V. Very Good

1,250-KVA, Allis-C, 200# psig. Rebuilt Excellent condition A-1
937-KVA G.E., 150# psig, 480 V. Rebuilt

1,000-KVA 440# psig, 750° FTT, Condg. New, never uncrated G.E. 480 V.

937-KVA Allis-C, 125/200# psig 480 V. Rebuilt, New Coils No. 1

625-KVA, Westg. 250# psig, Non-cond. 125#. B.P. Like New Machine

625-KVA, G.E., 125/175# psig, 480 V. A-1

WE OWN ALL ABOVE TURBINES. ARE IN STORAGE: IMMEDIATE DELIVERY

BOILERS:—WE CARRY A FULL LINE **DIESELS:—WE CARRY A FULL LINE**

SEND US YOUR SPECS.

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CHARLES WEAVER, Owner

ELECTRICAL AND MECHANICAL ENGINEERS
4145 PENOBSCOT BUILDING, DETROIT 26, MICHIGAN

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BUY or RENT From L. J. LAND for

- Dependable Equipment
- Reliable Rebuilding
- 1 YEAR GUARANTEE
- REAL VALUES

1 to 50 HP
NEW and REBUILT
TEFC—EX. PR.—Drip proof and Splash proof—Geared Head
IN STOCK

SQUIRREL CAGE MOTORS
3 phase

H.P.	Make	Type	Speed
250	G.E.	KT 559	1750
200	Wagner	RP226F	1800
200	Al.Ch. (2)	BB	880
200	G.E.	KF-6338	880
150	West.	CS	1150
150	West.	CS	580
125	Al. Ch.	AR	1750
100	West.	TEFC	3600
100	Al. Ch.	AR	1150
100	West.	CS	870
100	G.E.	IE-K	1800
100	G.E.	K-844	1175
75	West. (2)	CS-654C	1750
75	G.E.	IK	900
75	G.E.	KT-352	865
75	West.	CS	720
60	Howell	SCR	1800
60	West. (2)	CS-607	880
60	Rel.	AA	875
60	G.E.	KT-346	865
60	G.E.	TEFC(GH)	427
60	G.E.	FTR-528	3600
60	Elliott	196	3450
50	G.E. (2)	KT	1740
50	G.E.	XP	1750
50	G.E.	KF-445	1170
50	West (3)	CS	870
50	G.E. (2)	IK	870

SLIPRING MOTORS
3 Phase

H.P.	Make	Type	Speed
600	Cr. Wh.	131AQ	507
440	G.E. (2)	IM	450
400	Ideal		1150
400	West.	CW	450
400	G.E.	IM	870
250	G.E.	IM	435
225	Wagner	25 cy.	710
200	G.E.	MT559Y	1170
150	Wagner	31VRN	900
150	Burke		720
125	West.	CW	1750
125	Burke		600
100	G.E.	MT347	1150
100	G.E.	IM	690
75	Lincoln	IXM	1750
75	West.	CW	1150
75	West.	CW	720
75	G.E.	IM	690
60	G.E.	MT533	1750
60	West.	CW116	290
50	G.E.	MT-536	1150
50	Wagner		1150
50	L.A.	OGH	870
50	Cr. Wh.		900
50	G.E.	MT546	720
50	G.E.	IM	490

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
300	G.E.	ATI	900
260	G.E.	TS	900
200	West. (3)		900
180	G.E.	ATI	900
150	G.E.	TS	900
150	G.E.	TS	720
150	G.E.	ATI	900
100	G.E.	ATI	1200
75	G.E. (2)	TS	900
55	El.Machry.	BRKT	1200

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
200	West.	SK210	575
150	G.E.	L.C.	1750
100	Al.Ch.		1150
90/45	G.E.	RF-17	950/475
75	Cr.-Wh.	58H	850
75	G.E.	RC56	800
75	West (2)	SK-180	475
75	Cr. Wh.	CMC	875/950
60	West.	SK-160	680
60	West.	SK	250/1000
50	G.E.	CD	3600
46/90	G.E.	RF-17	475/1950
50	WEST (3)	SK-160	565
50	G.E.	CD	3600
50	G.E.	RF-17	250/1000
40	West.	SK-103	1750
40	G.E.	RC-31	1700
40	G.E.	CD-1441	400/1500
40	Rel.	461T	400/1200
35	West.	SK	250/1000
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West.	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200
25	West.	SK113	850

115 V.D.C. MOTORS

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr.Wh.	CCM	900
40	G.E.	DLC	1150
40	G.E.	RC	1050
40	G.E.	CD-113	850
30	Eck.		950
25	G.E. (2)	CD	1800
25	G.E.	CD93	1150
25	Cr.Wh.	CCM	750
25	West.	SA	600/1200
20	G.E.	CD85	1150
15	E.D.	7½S	650/1230
15	Cr.Wh.	CM	650
15	Cr.Wh.		1800
15	G.E.	RC	1200
10	Al.Ch.		900
10	E.D.	7½S	425/1700

550 V.D.C. MOTORS

HP	Make	Type	Speed
765	G.E. (3)	MPC	1045/1350

AC GENERATORS

KW	Make		Speed
180	G.E.	ATB	900
100	G.E.	ATB	360
40	G.E.	ASI	1200
15	G.E.	ASI	1200

AC GENERATORS
Driven by DC Motors

KVA	Make	D.C. Input	A.C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	Ely. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El. Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G.E. (4)	1200
325	G.E.	1200
30	Burke	1750
20	Reliance	1150

GENERATORS
250 V.D.C. Motor Driven

KW	Make	Speed
300	Elliott	1200
250 (2)	Cr.-Wh.	1200
250	G.E.	1150
200	G.E.	1200
150	West.	900
125 (2)	G.E.	1200
100	Delco	1200
100	G.E.	700
75	G.E.	1200
40	Rel.	1750
42	ABC (2)	1200
30	G.E.	1200
25	G.E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
150	West. (2)	1200
100	West. (2)	900
100	G.E.	1200
100	El. Machry.	1200
100	West.	1200
50	West. (2)	1150
30	G.E.	1150
30	L.A.	1450
25	El. Machry.	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
10,000	HVW	6/12
10,000	North.	2½/10
4,000	HVW	6/12
5,000	HVW	6/12
2,500	Chandeysson	6/12
125	Hobart	7½
500	Chandeysson	12
1,000	West. SK	24
1,500	Century	24
2,000	G.E.	24V
150	G.E.	30
1,000	G.E.	33
150	Watton	40
1,000	Chandeysson	40
200	G.E.	42
1,500	G.E.	50
1,500	Century	60
1,500	G.E.	60
1,000	G.E.	75

FREQUENCY CHANGERS AND GENERATORS

Size	Make	Output Frequency
150 KW	G.E.	150 cy.
154 KVA	G.E.	150 cy.
15 KW	G.E.	408 cy.
10 KW	G.E.	200/700 cy.
7½ KW	G.E.	408 cy.
5 KVA	West.	400 cy.

ELECTRIC HOISTS

1000# Y & T—D.C.
1000# Thor—Air.
1000# Y & T—A.C.
1000# Shepard—A.C.
2000# R & M—D.C. (3)
2000# C & M—D.C.

GUARANTEE YOUR INVESTMENTS!

- LAND gives 1 year guarantee.
- All equipment listed in stock.
- You can see your machines run and tested under power before shipment.
- Complete shop facilities with thoroughly trained & experienced mechanics (many have been with us over 25 years).
- Responsible Organization —41 years' experience.

Partial List ONLY

EST. 1910 — L. J. LAND INC. — 41st YEAR

156 GRAND STREET — Phone CAnal 6-4836 — NEW YORK 13, N.Y.

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT

BACKED BY 46 YEARS OF QUALITY AND SERVICE

YOUR BEST BET FOR 1952 - - - "Check with WAGNER First!"

OVER 46 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"

M-G SETS

KW	Mfr	Input V	Output V
500	G.E. HCC conv.	2300 AC	275 DC
300	Allis Ch.	2300/440 AC	125/250 DC
300	G.E.*	440 AC	275 DC
200	Gen. Elec.*	220/440 AC	250 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Gen. Elec.*	2300/440 AC	600 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	78 DC
100	Delco	220/440 AC	125/250 DC
100	Allis Ch.* (3)	2300/440 AC	60 DC
100	Gen. Elec.	220/440 AC	125 DC
75	Whse. (2)	220/440 AC	250 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
65	Whse.	220/440 AC	250 DC
50	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (2)	220/440 AC	125/250 DC
45	Gen. Elec.	220/440 AC	60 DC
45	Cr. Wh. b.b	220/440 AC	125 DC
40	Gen. Elec.	220/440 AC	550 DC
40	Whse. (2)	220/440 AC	125 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b.	220/440 AC	125 DC
30	Elec. Prod.	220/440 AC	50 DC
25	G.E. b.b. New	220/440 AC	125 DC
20	Northw'n.	220/440 AC	250 DC

*Syn. motor drive.

D.C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Gen. Elec.	CD198A	230	400/1200
200	Gen. Elec.	CD165A	230	850
150	Gen. Elec.	MPC	230	500/1200
100	Whse.	SK1s1	230	4.0/900
100	Gen. Elec.	C	230	875/1000
75	Whse (2)	SK143	230	850
75	Northw'n	S20	230	1750
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	851T	230	750
50	Gen. Elec.	RLC 204	230	500/1200
50	Gen. Elec.	LC	115	400/800
50	Cr. Wheeler	CMC	230	1750
40	Gen. Elec.	RC32	550	1200
40	Gen. Elec.	RC-32	230	1150
40	Cr. Wheeler	EH	230	1750
40	Whse.	SK140	230	775
40	Gen. Elec. (2)	CD115	230	675/1150
35/50	Gen. Elec.	CD128	230	575/1150
30	Whse.	SK110L	230	1150
30	Whse. (2)	SK90	230	1700
30	Star b.b.	SB	230	1750
25	Gen. Elec.	CD85	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b. New	CDM93	115	1150
25	Gen. Elec.	RF13	230	250/1000
25	Whse.	SK	230	1150
20	G.E. b.b. (5)	CDM83	230	1150
20	Whse. b.b. (2)	SK97	550	900
20	Gen. Elec. (2)	CD83	230	1750
20	Gen. Elec.	RF12	230	400/1600

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.
- SPEED REDUCERS.

D. C. GENERATORS

KW	Mfr	Type	Volts	Speed
500	Gen. Elec. 1 brg.	DMC	275	720
200	Gen. Elec.	CD	250	1150
150	Whse.	SK191	125/250	900
105	Century b.b.	1500 amp	70	1200
100	Gen. Elec.	C	250	750
75	Reliance b.b. New	310T	250	1200
75	Whse.	SK	250	1700
75	Gen. Elec.	RC36	125	1200
65	Whse.	SK140	250	1100
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	EW	125/250	1200
50	Cr. Wheeler	50H	250	900
45	Cr. Wh. b.b.	FH	125	1750
40	Whse.	SK	250	1200
40	Gen. Elec. (2)	RC32	250	1500
40	Gen. Elec.	RC35	550	1500
35	G.E. b.b. New	CDM93	125	1150
25	Whse	SK	250	1750
20	Gen. Elec. (2)	RC	125	1150
20	Gen. Elec. b.b.	CDM	250	1750

A. C. GENERATORS — 60 CYCLE

KVA	Mfr	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	4800	750
500	Allis Ch.	3 brg.	240/480	360
500	Gen. Elec.	ATB	240/480	900
312	Gen. Elec.	ATB	240/480	600
312	Gen. Elec.	ATI	240/480	900
300	Gen. Elec.	ATB	600	720
375	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
187	Gen. Elec.	ATB	240/480	900
150	Whse.		2300/480	600
125	Gen. Elec.	ATB	240/480	300
94	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
75	Gen. Elec.	ATI	240/480	1200
56	Gen. Elec.	ATB	240/480	1200
56	Gen. Elec.	ATB	240/480	900
31	Whse. b.b.	late	120/208	1200
10	Kato New (30)	b.b.	127/220	1800

A. C. MOTORS — SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	IM	360
1—	500	G.E. 3 brg.	I-M	150
1—	400	Gen. Elec.	I-M	514
1—	250	Whse. 2300V.	CW	450
1—	200	G.E. 2300V.	I-M	1800

1—	200	G.E. 2300V.	IM-17A	600
1—	250	Allis Ch. 2200V	ANT	514
1—	250	Cr. Wheeler	SR	600
1—	200	Cr. Wheeler	SR	600
1—	200	Gen. Elec.	I-M	360
2—	200	Gen. Elec.	I-M	600
1—	150	G.E. 2200/4400V. Vert.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	150	G E	IM-16	600
1—	150	Allis Ch. 2200V.	ANT	720
1—	125	G.E. 2200V.	IM-15	720
1—	125	Allis. Ch.	ANT	600
1—	100	Gen. Elec. New	M6324	1200
1—	100	Gen. Elec.	I-M	720
2—	100	Gen. Elec.	I-M	514
2—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT533	1200
1—	100	Cr. Wheeler	SR	600
1—	100	Northwestern	HW	1800
2—	75	Gen. Elec.	MT582	900
1—	75	Whse. 2200V.	CW	600
2—	75	Gen. Elec.	MT343	1800
1—	60	G.E. TEFC b.b.	M-6336	720
1—	60	Fair. Morse	BY	720
1—	60	Whse. 2200V.	CW710C	900
1—	60	Gen. Elec.	MT343	1200
1—	50	Allis Ch.	ANT	900
1—	50	Howell	BR437	1200
1—	50	Gen. Elec. Int.	ITC5613	600
1—	40	Whse.	CW636A	1200
1—	40	Gen. Elec.	MT552	600
2—	30	Gen. Elec.	MT326	1200
2—	30	Gen. Elec.	MT332	900
2—	25	Gen. Elec.	MT	900
3—	25	Gen. Elec. Int.	MTC5528	720
3—	20	Whse. b.b. New	CW364	1800

A. C. MOTORS — SYNCHRONOUS

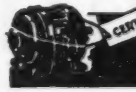
HP	Mfr	Type	Volts	Speed
750	Whse. .8PF	Cond.	4000/2300	900
700	Gen. Elec.	TS7459	2200	514
500	Gen. Elec.	ATI	220/440	900
300	Gen. Elec.	ATI	2300/550	450
300	Whse.	G	2300/440	600
275	G.E. 25 cycle		220/440	750
225	El. Machy.	BRKT	220/440	1600
200	Allis Ch. (2)	.8PF	2300/440	720
220	G E. 3 brg. .8 PF	ATI	220/440	514
200	Gen. Elec. .8PF	ATI	220/440	900
200	G.E.	TS	220/440	150
190	El. Machy.	3 brg.	220/440	514
175	Gen. Elec.	ATI	2200/550	450
175	Whse.	2 brg.	220/440	300
150	Gen. Elec.	ATI	220/440	300
125	El. Machy. (2)		220/440	1800
120	Burke b.b. .8PF	AC19	2300/440	1200
125	El. Machy.	B.B.	2400/4800	900
100	American b.b.	VOH	220/440	900
90	Gen. Elec.	TS7545	220/440	1200

A. C. MOTORS — SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr	Type	Speed
1—	500	G.E. 6600/4000 V.	I-K	1800
1—	500	Fair. Morse 2300V.	HS	1200
1—	500	G.E. 2300V.	KT7561	1800
1—	300	Gen. Elec.	I-K	900
2—	250	Whse. 2300V.	CS	1200
1—	250	Gen. Elec.	FT519AZ	3600
1—	250	Gen. Elec.	IK-17A	450
1—	250	Gen. Elec.	IK-17	600
1—	250	Gen. Elec.	I K	720
1—	200	Gen. Elec.	IK-17	514
2—	200	Reliance b.b. New	B6885S	1800
2—	200	Gen. Elec.	I-K	600
1—	200	Gen. Elec.	KT566	600
1—	200	U. S. b.b. New	8C587	1200
2—	200	Gen. Elec.	I-K-E13B	1800
2—	150	U. S. b.b. New	8C587	1200
1—	150	Reliance b.b. New	C9885	900
1—	150	Gen. Elec.	KT549	1800
2—	150	Gen. Elec. 2200V.	IK-15A	720
1—	150	Gen. Elec.	IK-16	900
1—	150	Gen. Elec. TEFC b.b.	K6323B	1200
1—	150	Gen. Elec.	IK-17	450
1—	150	Whse.	CS	720
2—	125	Al Ch 2200V. b.b.	ARX-836	900
1—	125	Rel. TEFC New	B6858	1400
2—	125	Gen. Elec.	K-558	900
1—	125	G E. b.b. New	K6210B	1200
1—	125	G E. New b.b. HT	KG6324	1200
1—	125	Con. 2200V b.b.	8C	1200
2—	125	G E. 2200V. TEFC	K6326	3600
2—	125	Reliance b.b. New	5058	1800
1—	125	Reliance b.b. New	B6085	900
2—	100	Reliance b.b. New	5084S	1800
1—	100	Reliance TEFC New	B5085	1200
1—	100	Whse.	CS	720
1—	100	Gen. Elec.	I-K	1200
1—	100	Rel. TEFC New	5053S	3600
1—	100	Gen. Elec.	IK-15	600
2—	100	Gen. Elec.	IK-14	900
1—	100	Reliance b.b. New	C5085	900
1—	75	Whse. Expl. Prf.	C8505	1200
1—	75	Wagner	22VRM	1200
1—	75	Rel. TEFC New	5048	3600
1—	75	Gen. Elec.	IK	3600
1—	75/90	Gen. Elec.	HJQ	900
1—	75	Fair. Morse b.b.	K-6335	900
1—	75	G E. TEFC 2200V.	K6325	900
2—	75	Gen. Elec.	I-K-14	900
2—	60	Gen. Elec.	KT548	900
2—	60	Howell b.b.	K504	1200
1—	60	Gen. Elec.	KT536	450
1—	60	Reliance b.b. New	C7505	900
2—	60	G E. Vertical	KT534	1200
1—	60	Gen. Elec.	I K	600
3—	60	G E. 2200V.	KT533	1800
2—	60	Reliance b.b. NEW	B504	1800
2—	50	Gen. Elec.	KT546	720
2—	50	G E Vertical	KT544	720
2—	50	Reliance b.b. New	CC504U	900
2—	50	Whse.	CS	1200
2—	50	Howell TEFC	K445	1800
1—	50	Fair. Morse b.b.	HJ 125D	900
1—	50	Gen. Elec.	KT527	1800
1—	50	Reliance b.b.	C585	600
1—	50	Whse. hiterq	C8505	900
2—	40	G E. 2200V.	KT523	1800
2—	40	Reliance b.b. New	CB104	1800
1—	40	Louis Allis b.b.	OX104	3600
2—	40	Gen. Elec.	KT525	1200
2—	40	Gen. Elec.	KT536	3600
3—	40	Gen. Elec.	KT544	900
6—	40	Whse. b.b.	CW 560	1200/900

A. C. MOTORS — 25 CYCLE

HP	Mfr	Type	Volts	Speed
275	G E synch	ATI	440	750
150	Whse.	HP	440	500
60	Allis Ch.	ART	440	1500
50	Gen. Elec. Int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
30	Gen. Elec.	MT343	440	750



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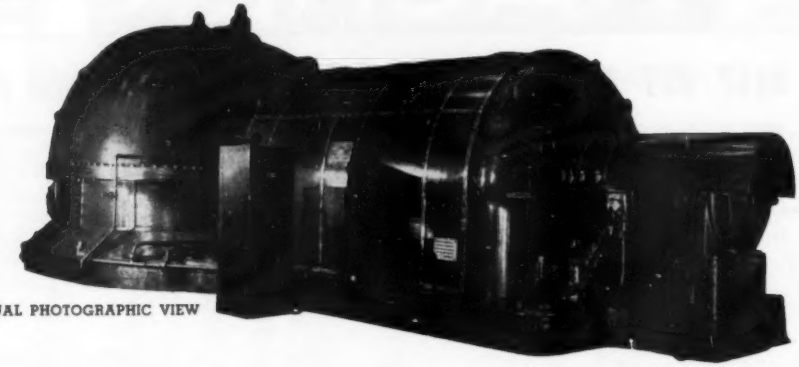
QUICK SHIPMENT FROM STOCK—
LOW PRICES — FULL GUARANTEE
Send for Complete Stock Lists

25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° T.T. complete with direct connected shaft exciter, switchboard, a 30,000 square foot Westinghouse surface condenser and condensing accessories, including 2—150,000 pounds steam per hour B&W sectional header cross drum boilers, 250# pres., 550° T.T. equipped with Taylor retort stokers.



ACTUAL PHOTOGRAPHIC VIEW

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 5-stage, 2300/4000 volts, 200# P.S.I., 600° TT.

4000 KVA Allis, 2300 volts, 150-200 PSI.

3750 KVA Westghse. 2300 volt, 200 PSI.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing alternating current generator LESS TURBINE.

2500 KVA Westghse. 2300 volt, 250 PSI.

1563 KVA Allis, 600 volts, 200 PSI.

1250 KVA G.E. AUTOMATIC EXTRACTION BLEEDER 2300 volts, 250 PSI.

937 KVA Allis, 480 volts, 250 PSI.

780 KVA Allis, 480 volts, 150 PSI.

625 KVA G.E. 480 volts, 150 PSI.

Non-condensing—3 phase, 60 cycle

940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.

625 KVA G.E. 480 volts, 125-150 PSI, 20# back.

375 KVA Westghse-Moore 480 volts, 250 PSI 5-10# back.

250 KVA Allis 480 volts 125 P.S.I.

125 KVA G.E., 2300 volts, 150-200 PSI.

125 KVA Westghse. 2400 volts, 150-250 PSI 10# back.

Direct Current

500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.

100 KW (2) G.E., 125 volts, 200-275 PSI.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing.

MOTOR GENERATOR SETS

100 KVA Westghse. 60 cycle, 2400 volts, alternator connected 135 HP, 250 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

50 KW G.E. 125 volt direct current 1200 RPM to a 3 phase, 60 cycle, 220 volt syn. motor.

JANUARY BARGAINS SPECIALLY PRICED

547 HP, 250# pres. and three 400 HP, 225# pres. B&W water tube boilers.

8000 sq. ft. Wheeler, 4400 sq ft. Worthington, 2000 sq. ft. Worthington and one 1500 sq. ft. Westinghouse surface condensers.

4900 GPM and 3500 GPM Allis 2-stage pumps, 130 ft. hd. each direct connected 400-325 HP Allis 3 phase, 60 cycle, 2300 volt motor.

1250 KVA E.M. 3 phase, 60 cycle, 4000/2300 volts synchronous generator direct connected 38D8-1/8 O.P. Fairbanks Diesel Engine.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I., G.E. turbine.

200 KVA G.E. 3 phase, 60 cycle, 240 volt, 720 RPM alternating current generator.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Syn. (condenser).

900 HP Allis, 2200 volts, 150 RPM.

UNAFLOW GENERATOR UNITS

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal engine, 125-150 PSI.

240 KVA G.E. 480 volt generator connected Skinner horizontal engine 125-140 P.S.I.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

60 KVA G.E. 240 volt 300 RPM generator connected Skinner engine 125 P.S.I.

Direct Current

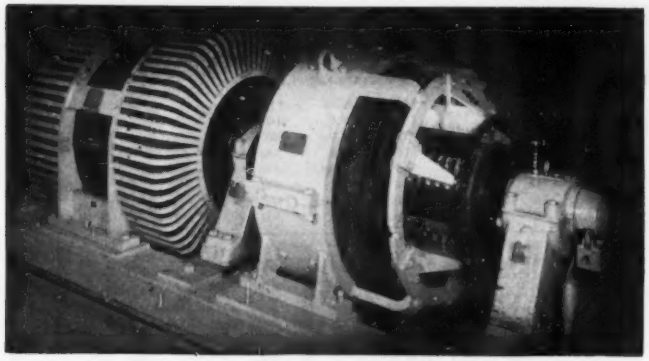
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.

20 KW Allis 125 volt generator connected Hill vertical Diesel engine.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422



500 K.W. Westinghouse Motor Generator Set

MOTOR GENERATOR SETS
Philadelphia Stock

1—1000 K.W. Westinghouse 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Motor .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels Modern Unit—Can furnish 60 cycle 2300 or 13200 volt.

1—600 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 phase, 60 cycle. 2300 volt A.C. & D.C. Panels—Can furnish 3 ph. 550 V. or 2300 V.

1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #8130447-48 (year 1935) See actual photo above.

1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/6/2300 V. A.C. & D.C. Panels.

1—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.

1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM—Automatic Controller & D.C. Panel.

2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.

1—100 K.W. Al. Chalmers 250 Volt 1200 RPM 150 H.P. Syn. Motor 2/60 or 3/60 any voltage.

1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Motor, 3/60/220/440/1200 RPM.

1—75 K.W. Burke 250 Volt, 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 phase, any voltage.

Smaller Sizes and Types—Advise Requirements.

DIESEL GENERATORS

2—1250 KVA GM 3/60/2300/720 RPM complete Plants—Used 4 years.

1—1000 KVA Hamilton 99 DA 3/60 2300/4160 600 RPM—New 1943—Never used.

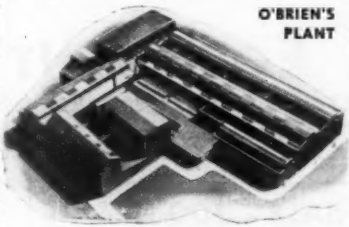
1—625 KVA Baldwin—Series 600 3/60/2300/514 RPM—New 1948—1500 hours.

1—225 KVA General Motors, Twin 671 3/60/440. —New 1941.

ELECTRIC MOTORS

Q.	H.P.	Make	Type	Volts	Speed
3	500	West.	CS	6600	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (3 brg.)	550	600
1	125	Cent.	SC	440	1800
2	100	G.E.	Syn.	440	300
1	75	West.	CW	440	1200
1	50	West.	CS	440	3600

O'BRIEN'S PLANT



A CORDIAL INVITATION
VISIT OUR PLANT DURING MAINTENANCE SHOW
Convention Hall — Philadelphia, Pa.
January 14 to 17

AIR COMPRESSORS

1—12,000 CFM Ingersoll-Rand Turbo Compressor, 3.25# pressure, 250 HP, 3/60/440/3600 RPM.

3000 CFM 5 psi Turbo 90 HP 3/60/440

1—734 CFM Sullivan 60 lb., 13 and 13x8.

2—528 CFM Chicago NSB, 100 lb., 285 RPM V-belt 14x12.

2—368 CFM Ingersoll ER-1, 12x10, 100 psi., 50 HP, M.D. 3/60/220.

1—360 CFM Schramm Vertical V belted on steel base, 75 HP motor 3/60/220.

1—277 CFM Chicago PB4 Air Cooled 50 HP V-Belt Motor Drive.

1—215 CFM Penna. 3A 10x8, 50 lb.

2—175 CFM Ingersoll ER-1, 9x8, 100 LB.

2—89 CFM Chi. TB—6x7—150 lb.

CENTRIFUGAL PUMPS

Q	GPM	TNH	Description	Size	HP	Speed
2	10,000	200'	LeCourtenay	20"	624	870
2	10,000	100'	LeCourtenay	20"	350	870
1	10,000	114'	De Laval	18"	370	988
1	9,000	88'	De Laval	18"	250	870
2	8,150	132'	LeCourtenay	16"	350	1150
1	8,000	110'	Worthington	14"	500	1200
2	7,000	200'	LeCourtenay	16"	423	1000
2	6,500	100'	Worthington	14"	200	1200
1	6,000	110'	Ingersoll-Rand	12"	500	1200
2	5,000	125'	Worthington	14"	200	1200
1	4,000	110'	Ingersoll-Rand	12"	500	1200
1	3,500	47'	Southwalk	12"	75	870
1	3,100	42'	Worthington	12"	50	1150
1	2,310	24'	Worthington	12"	20	860
2	1,700	95'	De Laval	10"	60	1750
1	1,500	231'	Allis-Chalmers	8"	150	1750
1	1,200	40'	Worthington	6"	15	1750

TURBO GENERATORS

1—625 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Condensing 180 PSI 35 lb. B.P. New 1936.

1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.

2—300 K.W. West. Non-Cond. 3/60/440 125 psi 5 B.P. New 1938

1—300 KW West. 3 wire 125/250 Volt D.C., Non-Cond. Turbo Units 125 PSI, 5 lb. B.P. New 1938—(See Actual Photo.)

1—75 KW G.E. Non-Cond. D.C. 125 volt.

1—35 KW G.E. Non-Cond. D.C. 125 volt.

BOILERS (ASME)

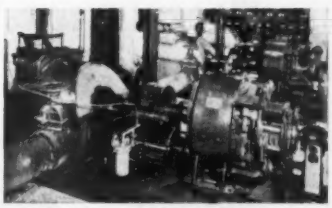
1—106 H.P., Keeler, Self-contained, 125#

2—240 H.P., Keeler, Horizontal, Long-Drum, Water Tube, 200#

1—250 H.P., Bigelow, Self-contained, 125#

2—360 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr., Water wall, 250#

1—390 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr. Water wall, 300#



3—300 KW D.C. TURBOS—125/250 Volt

"Everything from a Pulley to a Powerhouse"

SINCE 1915

THE O'BRIEN MACHINERY CO.

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RIO DE JANEIRO — BRASIL

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
400	G.E.	I-M	1200	S. B.
300	G.E.	I-M	1200	S. B.
200	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1800	S. B.
100	G.E.	MT-300	1800	S. B.
100	G.E.	I-M	900	S. B.
100	G.E.	I-M	720	S. B.
100	G.E.	MT-343	1200	S. B.
75	G.E.	I-M	900	S. B.
75	G.E.	MT-343	1200	S. B.
75	G.E.	I-M	900	S. B.
75	West.	CW	720	S. B.
75	G.E.	I-M	720	S. B.
60	G.E.	MT-333	1800	S. B.
40	G.E.	I-M	1800	S. B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
150	G.E.	K-8826	3600	TEFCBB
150	G.E.	K-8826	1800	TEFCBB
125	G.E.	K-8526	1200	TEFCBB
100	West.	CS-6075	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	CS-5045	1800	TEFCBBXP
60	G.E.	K-8945	1800	TEFCBBXP
60	L.A.	80-44	1800	B. B. open
60	F.M.	QS-444	1800	B. B. open
50	Master	FB-404	3600	TEFCBBXP
50	G.E.	K-445	1800	TEFCBB
50	G.E.	K-405	1800	S. B. drip
50	West.	CS-445	1200	S. B. open
50	G.E.	K-5045	1800	TEFCBBXP
40	A.C.	AR-444	3600	TEFCBBXP
40	G.E.	KF-3655	3600	B. B. splash
40	West.	CS-405	1800	TEFCBB
40	L.A.	K-400	1800	TEFCBBXP
40	G.E.	404	1800	B. B. open
40	Cr. Wh.	SC-445	1200	TEFCBB
30	G.E.	KF-3659	3600	B. B. splash
30	West.	CS-3055	3600	S. B. splash
25	Line.-Weld	DBD-328	3600	B. B. open
25	West.	CS-364	1800	S. B. splash
25	G.E.	K-364	1800	S. B. drip
20	G.E.	K-364	1800	S. B. drip
20	L.A.	EX-364	1800	TEFCBBXP
20	G.E.	KF-464	1200	TEFCBBXP
20	G.E.	KG-446	900	TEFCBBXP
20	G.E.	KF-486	900	TEFCBBXP
15	L.A.	EX-326	1800	TEFCBBXP
10	West.	CS-2042	3600	TEFCBB
10	Howell	EKBB-25-5	1800	TEFCBBXP
10	Reliance	AA-CB-324	1800	TEFCBB
10	West.	CS-324	1800	TEFCBB
10	West.	CS-324	1800	B. B. open
10	L.A.	EX-326	1200	TEFCBBXP
10	G.E.	K-364	1800	B. B. drip
10	L.A.	K-185B	1800	TEFCBB
3	G.E.	K-224	3600	TEFCBBXP
3	L.A.	EX-225	1800	TEFCBBXP

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
200	Wagner	RP-2-28	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-364	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.
50	G.E.	KT-342	900	S. B.
50	G.E.	KT-346	900	S. B.
40	G.E.	K-444	1800	S. B.
40	G.E.	KT-323	1800	S. B.
40	West.	CS	1200	S. B.
40	G.E.	KT-336	900	S. B.
40	F.M.	B-H12D	900	S. B.
40	G.E.	KT-542	720	S. B.
35	Triumph	B-12	900	S. B.
35	G.E.	I-L	900	S. B.
35	G.E.	I-K	720	S. B.
30	G.E.	KT-312	1800	S. B.
30	West.	CS	1200	S. B.
30	G.E.	KT-332	900	S. B.
25	G.E.	KT-312	1800	S. B.
25	West.	CS-471	1800	S. B.
25	Century	SC-30	1200	S. B.
25	G.E.	I-K	720	S. B.
25	F.M.	B-H12-B	720	B. B.
20	West.	CS-364	1800	S. B. B. splash

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from 1 HP up to 900 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER EQUIPMENT COMPANY

8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.
Telephone: Genesee 5629

375 KVA - FOR SALE - 300 KW
WORTHINGTON-WESTINGHOUSE
INSTALLATION

COMMERCIALLY UNUSED

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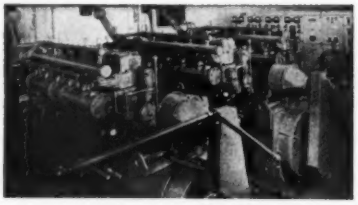
IMMEDIATE DELIVERY



Each Plant consists of

3 Worthington Model 8B 5—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.
Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.
Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.
Complete with all accessories and auxiliaries including evaporative coolers—switchboard—distribution panel.

OWNED & OFFERED BY

KANE-McGUIRE COMPANY
Single units available

1492 East 32nd Street
Brooklyn, New York
PHONE: WHitehall 3-6843

TURBO-GENERATORS

250 KW, 300 KW A.C. and D.C.

2000 KW 3 phase, 50 cycles, 6300 volts

Immediate delivery

Packed in original crates
Complete Specifications and Details Upon Request

INTERNATIONAL FERMONT MACHINERY CO., INC.
115 BROADWAY
NEW YORK 6, N. Y.

MOTOR GENERATORS

1—750 KW Al-Ch Syn. 250 V. 720 RPM
1—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW RIDGWAY Syn. 250 V. 900 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
1—100 KW RIDGWAY Syn. 250 V. 1200 RPM
2— 50 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS

1—500 KW G. E. Syn. 250 V. 1200 RPM
2—500 KW WEST. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
2—300 KW Al-Ch Syn. 250 V. 1200 RPM
1—150 KW G. E. Syn. 250 V. 1200 RPM
2—100 KW G. E. Syn. 250 V. 1200 RPM

ARMATURES

1—500 KW G. E. 250 V. Generator 900 RPM
1—300 KW G. E. 600 V. Converter 1200 RPM

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

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COMPRESSORS
VACUUM PUMPS
GET BETTER FOR LESS
YOUR CHOICE:
American—Bury—Chicago—
Curtis—Davey—Gardner
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HEAR-HERE
American Rebuilts
Are Best
AMERICAN AIR COMPRESSOR CORP.
Dell Ave., & 47th North Bergen, N. J.

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

FOR SALE
GENERAL ELECTRIC FREQUENCY CHANGER SET

600 KVA, 3 phase, 120 cycles, 475 volts, type AT8-BL, frame 984Y, .65 PF, 1200 RPM, 1 bearing—with direct connected 5 KW, 125 volt exciter—connected to 800 HP, synchronous, 3 phase, 60 cycle, 550 volt, type TS, frame 9834, 1200 RPM, .8 PF, 2 bearing motor—with direct connected 5 KW, 125 volt exciter with G.E. starting reactor, type R-543 and panels for synchronous motor.

Call—MAIN 4-5900 • *Write*
EMPIRE ELECTRIC CO., INC.
87 Jay St. Brooklyn 1, N. Y.

ELECTRICAL EQUIPMENT
REBUILT AND GUARANTEED
PROMPT SHIPMENT — PARTIAL LISTING

Electrical Equipment—Rebuilt and Guaranteed—Motors—Generators—Mill Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed—Motors—Generators—Mill Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed

800/1600 AMPERE ARC WELDING MOTOR GENERATOR SETS

Each set consists of two generators and one motor, mounted on base. Each Generator: Northwestern Type K20DR, 800 ampere, 50 volts, 1750 RPM. Motor: 125 HP. Allis Chalmers, Type AR, 2200 volts, 3 phase, 60 cycle, 1750 RPM.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
5	7½	810	550	G.E.	MTC-5201
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HT-11
2	111	870	550	G.E.	TTC-5008
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-658
2	25	1130	550	G.E.	MT-223
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	??VRR
1	30	865	440	West.	CW-646
1	30	870	440	G.E.	MT-532
1	30	575	440	G.E.	MT-356
2	35	600	440	F-M	HV-H14A
2	40	865	2300	Al. Ch.	ARY-228C
1	40	580	440	G.E.	MT-344
1	50	1150	440	G.E.	MT-536
1	50	865	440	West.	HP-17A
1	50	870	440	G.E.	MT-559
5	522	850	220	G.E.	IQC-5813***
1	60	585	440	West.	CW-758
1	60	570	550	G.E.	MTC-5544
1	60	345	550	West.	CW-928
1	802	575	440	G.E.	MTC-5352
2	125	450	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	585	550	West.	CW-1002
1	200	495	2300	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
3	300	900	440	G.E.	IM-17
2	300	880	440	G.E.	IM-17A
4	330	1775	440	G.E.	IM-815A
2	350	580	2200	G.E.	IM-17A
1	400	595	550	West.	CW
1	600	1770	440	G.E.	IM-815C
1	700	735	4000††	West.	CW

220 volt motors can be reconnected for 440 volts.
†Intermittent rating ***2 phase.
**New ††25 cycle.
*Also 440 or 2300 volts. †Also 440 or 550 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding & Direct Connected Exciter.

Qn	KVA	RPM	Make	Volts
3	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	Hp.	Speed	Make	Type
10	2	850	Reliance	T-22T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E	CD-75
3	15	825	West	SK-80
1	20	1750	L.A	OVA-LA51
1	20**	1450	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
1	20**	1450	G.E.	CDM-83
11	20	750	West.	SK-110L
17	25	935	West.	SK-120
1	30	1140	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	850	G.E.	RC-16
1	150	700	Al. Ch.	
2	200	1150	G.E.	RC-28
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	Hp.	Speed	Make	Type
6	5/7½	600/1800	G.E.	BA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RP-11
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RP-13
1	25	500/1500	G.E.	RP-12
1	25/29	300/1200	G.E.	RP-13
1	30/40**	400/1600	G.E.	CD-1226
1	35	500/1500	West.	SK-143
1	40/50	400/1200	West.	SK-163
1	75	500/1500	Cr. Wh.	CCM
1	75	375/750	Cr. Wh.	CMC-125H
2	100	325/900	G.E.	MPC-A
5	100	400/1200	Al. Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	450/1000	West.	SK-220
2	275	350/500	G.E.	MPC

**New

Above Items Represent a Partial Listing Only. Your Equipment is Located in Our Cleveland Warehouse. Inquiries Will Receive Our Prompt Attention. We have Controls for Most Items Listed.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
3	3	1160	440	L.A.	JS-254
4	5	1730	440	G.E.	K-254
2	7.5	1740	440	G.E.	K-284
1	10	1735	440	West.	CR-324
1	10	1145	440	West.	CR-326-EXP
1	10	1140	440	Wagner	CPJ-326
1	15	1175	440	L.A	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CR-W504
1	40	3565	440	G.E.	KP-4058

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
1	3	1140	440	L.A	FS-254
23	5	1750	440	L.A	FS-254
1	5	1735	220	G.E.	K-274
1	5	1160	440	L.A.	FX-284
1	15	1150	440	L.A.	FX-365
1	60	1780	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1108
3	150	880	440	L.A	FX-1368
1	150	700	440	G.E.	KP-6335

OPEN TYPE MOTORS

Qu	HP	Speed	Volts	Make	Type
2	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CR-326
5	20**	1750	440	Wagner	RPI-384
1	20	1750	220	West.	CR-W384
1	20	1755	220	G.E.	KT-512
2	20	1200	440	West.	CR-344C
2	20	900	220	G.E.	FTR-522
5	25**	1740	440	Century	SC-361
1	25	1160	440	West.	CR-447C
1	25	900	220	Howell	8CRR-356***
1	25**	875	440	Master	PR-405
2	25	575	440	G.E.	KT-512
1	30	2550	550	G.E.	K-364S
1	30	1755	220	G.E.	FT-513
1	30	1160	440	West.	CR444
1	30	870	220	West.	CR446
1	40**	3545	220	G.E.	KP-4048
2	40	1750	440	West.	CR-5808
2	60	900	2300	G.E.	FTR-556
4	50**	1740	440	Wagner	RPS-405
1	50	850	220	West.	CCL
2	60*	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-548
1	75	1160	440	West.	CR-602C
2	75	870	220	West	CR-706A
2	75	885	2300	G.E.	KT-552B
1	100	890	220	West	C
1	100	580	2200	G.E.	IK-15A
2	100	580	2200	West	CR-838
1	100	495	2300	Al Ch.	AX
1	125	435	440	Al Ch.	AR
2	125	480	2300	G.E	I-17-FR
1	200	588	550††	G.E.	KT-5809
2	200	587	2200	West.	CR-59A
1	500	1200	140	G.E.	KTP-547
1	700	1800	2300/ 4000	West.	CR-1-59D12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ††Reconnectable for 440 volts.

250 VOLT DYNAMOMETERS
Cradle Type With Scale and Control

Qn.	Make	HP	RPM	Type
1	G.E.	150	2700/5000	TLC-36
2	West	150	2200/5000	SK-131
1	G.E.	200	1200	C

MOTOR GENERATOR SETS
125 and 250 Volts D.C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/2200
10	West.	1750	125	220/440
10	West.	1450	125	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440
16	West.	1750	125	2200/440
25	G.E.	1200	125	220/440
50	Al. Ch.	1750	125	220/440
50	G.E.	1720	125	220/440
75	G.E.	1200	125	220/440
100	West.	1100	125/250	2300/4100

Note: 3KW, 5KW & 7.5KW, 250V Sets Available.
**New. *Synch. Motor Driven. $50 Cy. $25 Cy.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—15830 KVA G.E. Cond. 60 cy. 13200 V. 275-lb.
1—10000 KVA G.E. Cond. 25 cy. 6600 V. 200-lb.
1— 6250 KVA Allis Cond. 60 cy. 4000 V. 175-200 lb.
1— 5000 KVA West. Extr. Cond. 60 cy. 480 V. 385-lb.
1— 4375 KVA G.E. Cond. 60 cy. 2300 V. 200-lb.
1— 3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1— 2500 KVA G.E. Extr. Cond. 60 cy. 490 V. 185-200 lb. Steel Valve Chest
2— 2250 KVA G.E. Cond. 60 cy. 240-480 lb.
1— 1875 KVA West. Cond. 60 cy. 2300 V. 170-lb.
1— 1875 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 1563 KVA G.E. Extr. Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
1— 938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 938 KVA West. Extr. Cond. 60 cy. 2300/4160 V. 200-lb.
1— 750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 625 KVA West. Cond. 60 cy. 480 V. 150-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP

DIESEL ENGINE UNITS

1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1—1000 HP Superior 2300 V. 60 cy.
1— 900 HP Amer. Loco. 250 V. DC
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS

1—675 KVA Chase Corliss 2300 V.
1—250 KVA Ames Vertical Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—150 KVA Ames Vertical Uniflow 240 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	275/285	13800	300
3	1000	G.E.	600	13700	900 Auto.

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
1	1500	G.E.	4800	900
1	1500	West.	2300	900

SPECIAL

1—500 KW Crocker Wheeler 250 volt D. C. generator 300 RPM, direct connected to Ames Vertical Uniflow, non-condensing engine.

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
2	4500	Multi Anode	600	13800
4	3250	Ignitron	650	33000
1	1000	Multi Anode	600	13800

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	2000	G.E.	600	4000	450
1	1000	G.E.	600	13200	514
1	500	West.	125	2300	720
1	400	G.E.	250	6600	720
1	75	West.	125	440	1200

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
2	700	West.	2300	200
1	600	G.E.	2300	1800
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	600
1	300	West.	2300	900
1	250	Cr. Wh.	440	330
1	115	West.	440	1200

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	5000	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
1	2300	G.E.	25/62½	750
1	2450	G.E.	62½/25	750
1	1790	West.	60/24	720
1	1250	G.E.	25/60	300

TRANSFORMERS — 60 CY.

3— 3333 KVA West. 13200—7620/13200 Y
4— 2000 KVA West. 69000—13800
3— 1000 KVA West. 66000—22000/24000/40000 Y
1— 2500 KVA G.E. 59/73 KV—5 taps, 3 ph.
4— 2500 KVA West. 44000—11000
3— 1500 KVA Wag. 41000—6900 NEW
4— 1000 KVA West. 44000—11000
3— 200 KVA Mel. 44000/22000—440/220
3— 100 KVA Wag. 44000—7200
3— 75 KVA West. 44000—7200/12470
3— 8333 KVA West. 13800—13950
3— 100 KVA Wag. 36000—7200/12470 Y
1—18750 KVA A.B.B. 34840—11000, 3 ph.
6— 1500 KVA Pitts. 33000—2400
3— 200 KVA West. 33000—2400
3— 167 KVA G.E. 33000—2300/4000 Y
6— 150 KVA G.E. 34500—2300/4600
4— 150 KVA G.E. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 75 KVA Mel. 33000—2300/6900
3— 75 KVA Wag. 33000—7200/12470 Y
3— 50 KVA G.E. 33000—2300
4— 450 KVA A.C. 25410/44000—13280/23000
4— 750 KVA Wag. 19650/33000 Y—6900/11950
3— 200 KVA G.E. 11500—220/110
3— 200 KVA Mel. 11000—2300
3— 150 KVA Mel. 7620/13200 Y—120/240
3— 667 KVA Kuhl. 7200/12470 Y—2400
3— 100 KVA West. 7200/12470 Y—2400
4— 50 KVA G.E. 7200/12470 Y—2300
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900/11900—2400
1— 100 KVA G.E. 2300—575, 3 ph.
3— 15 KVA Stand. 450/225—117
1— 37½ KVA G.E. 230/460—115/230

OIL CIRCUIT BREAKERS

4—600 A. 154 KV G.E. FHKO-39-2500 Outdoor
1—600 A. 73 KV G.E. FHKO-236-500 Outdoor
1—400 A. 37 KV G.E. FHKO-136-350 Outdoor
1—400 A. 37 KV West. O-221-500 Outdoor
1—400 A. 15 KV G.E. FKO-37-40 Outdoor
4—600 A. 15 KV G.E. FHKO-139-750 Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, WOrth 4-1470

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Expert Orders Carefully Executed"

IMMEDIATE DELIVERY —1-ea. 60,000# hr. capacity 4-Drum Stirling type, 250# psi, (10,000 sq. ft. H.S.) 525° F.TT Boilers. Condition excellent, suitable any fuel, now oil fired.

1—48,000# hr. capacity Boiler, otherwise same as 60,000# (8,500 sq. ft. H.S.) above boilers.

768 HP B&W Sterling Boiler, 200#, with new tubes & superheaters.

● We have many other boilers in sizes of 250 to 600 HP, 200 to 450# pressure. See our September Power ad

Turbo-Generators, Condensing, 300 to 10,000 KW.
Turbo-Generators, Non-Condensing, 200 to 2500 KW.
Frequency Changers
Motor-Generators & Diesel-Generators

TRANSFORMERS! Quick Delivery, Various Sizes
Rebuilt like NEW—Guaranteed.

Send us your INQUIRIES *for* ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.

BOILERS

100,000 lbs per hr., 250#, Intgr. Furnace
87,000 lbs per hr., 350#, Steam
300 HP HRT, 150#, New 1941

TURBO GENERATORS

4000 KW., 300# Bleeder Type, Condensing
2500 KW., 225# Non-Condensing

DIESEL PLANTS

1250 KW, F.M., 300 RPM 2400 V. ('42)
1200 KVA (in 3 units) 514 RPM, 440 V.

GENERATOR

3500 KW, 3/60/2300 V., 3600 RPM, Rewound. Complete overhaul by G.E. Co.

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave. New York 33, N. Y.

MOTORS—M.G. SETS—COMPRESSORS, ETC.

M.G. SETS & CONVERTERS

KW	MAKE	RPM	D.C.	A.C.
750	Al. Ch.	720	250	2300
500	West. Rotary	1200	250	2300
400	West.	720	550	2300
300	GE	1200	250	2300
300	GE Rotary	600	250	2300
300	West.	1200	250	2300
300 (2)	Al. Ch. Rotary	1200	250	2300
300	West.	1200	550	2300
150	GE	900	550	2300
150	West.	1200	250	2300
50	G.E.	1200	250	2300

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	GE	450	Sl.Rg.
300	GE	450	Sl.Rg.
100	GE	600	Sq.Cg.
150	GE	600	Syn.
100 (2)	Allis	720	Sq.Cg.
100	West.	900	Syn.
100	West.	1200	Sq.Cg.
100 (2)	GE	1750	Sq.Cg.
100 (2)	GE	450	Sl.Rg.
75	West.	900	Sq.Cg.
75	GE	600	Sl.Rg.
60	West.	600	Sl.Rg.
50	GE	1750	Sq.Cg.
40	GE	900	Sl.Rg.
40	West.	900	Sq.Cg.

AIR COMPRESSORS

356 CFM Chg. Pr. 12"x10" NSB 100#.
415 CFM Allis Rotary 100#.

MOORHEAD ELECTRICAL MACHINERY COMPANY
361 Noblestown Road (Est. 1919) Oakdale, Penna. Pittsburgh District

SELLING FOR CUSTOMERS

2—100 KVA, 1 phase 60 cycle 2400 to 240/480 Pyranol trans.
1—50 1—100 & 1—150 KW M.G. Set 220/440 AC to 250 DC.
1—375 KVA Westinghouse noncond. turbine set.
1—37½ KVA 240/480 Diesel set.
What do you need—What have you to sell—Make use of our nation-wide service when buying or selling equipment.

H. BLANE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Ill.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

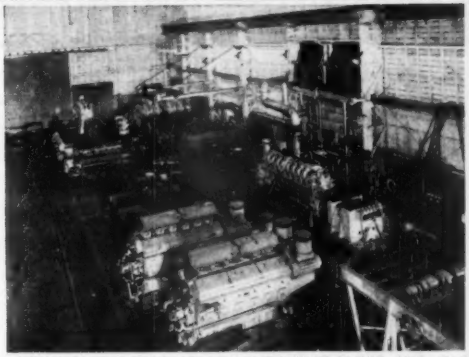
Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

A.G. SCHOONMAKER CO., INC.

52 CHURCH ST., NEW YORK 7, N. Y.

PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1230	Nordberg	F6G168SC	1750	327
1136	Fairbanks Morse	38D	1600	720
1000	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
500	Alco	5-12-1/2x13T	750	600
500	Worthington	EE	750	327
500	General Motors	8-567	720	720
340	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
300	Enterprise	DSG-6	450	450
300	General Motors	8-268A	450	1200
264	Superior	KNA	396	514
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
100	General Motors	3-268A	150	1200
100	Worthington	88-5	150	600
60	General Motors	6-71	90	1200
50	Caterpillar	D-8800	76	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

Most all units still on foundation. Many may be seen operating

DIESEL UNITS

1000 KVA Elliott-DeLaverne
875 KVA EM-Worthington EE5
550 KVA EM-Worthington EE8
375 KVA (2) GE-DeLavergne VO
375 KVA Fairbanks-Morse 32E14
250 KVA Fairbanks-Morse 32E14
250 KVA GE-Buckeye-E
187 KVA GE-Buckeye-E
175 KVA Fairbanks-Morse 32E14
125 KVA GE-General Motors
90 KVA Fairbanks-Morse 32E14
75 KVA (2) General Motors
62 KVA International Harves. (package)
50 KVA (2) Fairbanks-Morse 42F
225 HP Buckeye (belted)
180 HP Fairbanks-Morse (belted)
128 HP (4) Caterpillar (belted)
120 HP Fairbanks-Morse 32E
120 HP Superior (belted)

GAS ENGINE UNITS

750 KVA Elec. Mchy.—800 HP Worthington Nat. Gas

BOILERS

427 HP Bigelow 3 dr. 200#
395 HP Union 3 dr. type L, 300#
370 HP Wicks Cr. drm. (2) 300#
333 HP Bigelow 3 drm. 250#
309 HP Combustion 3 dr. 160#
285 HP B&W 3 dr. 250#
255 HP (2) Combustion 200#
220 HP (2) Vogt 3 dr. 160#
Three 250 HP HRT 150#

TURBO GENERATOR UNITS

3750 KVA Wghse. 3/60/600 v; bleeder
2800 KVA GE 3/60/2300 v; non-cond.
1250 KVA GE 3/60/480 v; bleeder
937 KVA Wghse. 3/60/480 v; bleeder
750 KVA Al.-Chal 3/60/480 v; cond.
2800 KVA GE 3/60/2300 v; non-cond.
250 KVA GE 3/60/600 v; non-cond.
187 KVA GE 3/60/480 v; non-cond. 375#
SURFACE CONDENSOR 4000 Sq. Ft. Wghse.

ENGINE-GENERATOR UNITS

3/60/480/240 v.

312 KVA GE-Skinner unif.
250 KVA (3) Elec. Machy.—Skinner unif.
187 KVA Wghse.-Ames vertical
62 KVA GE-Ames Unit.

Above listed units are only a few of our "SPECIALS." Advise your plant requirements.

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

MOTORS • GENERATORS • TRANSFORMERS

7x7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 3/60/220/440/1800 X-Proof.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

TURBO-GENERATORS

2000 K.W., 3 ph., 60 cy., 150 lbs G.E.
1000 K.W., 3 ph., 60 cy., 250 lbs G.E.
750 K.W., 3 ph., 60 cy., 250 lbs extract. G.E.
500 K.W., 3 ph., 60 cy., 150 lbs G.E.
150 K.W., 250 v., new Westgh., D.C.

DIESEL UNITS

62½ KVA., 3-60—Caterpillar
37½ KVA., 3-60—Ready Power
100 K.W., 250 v., D.C. Superior Deico

UNUSED PUMPS & MOTORS

Union Steam Co., pumps all 250 ft. head with new Louis Allis motors, 1750 RPM

1—200 GPM, 30 HP motor
1—400 GPM, 50 HP motor
1—500 GPM, 75 HP motor
1—900 GPM, 100 HP motor

TRANSFORMERS

3—200 KVA Westgh., 11500 x 480 V.
7—100 KVA Gen. Elec., 11000 x 2200 V.
3—100 KVA Maloney 11400 x 2200 V.
2—100 KVA Gen. Elec., 2400 x 120—240 V.
4— 50 KVA Gen. Elec., 11000 x 2300 V.
2— 50 KVA Westgh., 13800 x 230—460 V.

3 PH., SLIP RING MOTORS

425 HP., Gen. Elec. MT414Y, 392 rpm.
200 HP., Gen. Elec. 1M,—585 rpm.
200 HP., Westgh., CW., 1750 rpm.
200 HP., Gen. Elec., 1M., 435 rpm.
150 HP., Gen. Elec. 1M., 1800 rpm.
150 HP., Gen. Elec. 1M., 514 rpm.
100 HP., Reliance AW6085—600 rpm.
100 HP., Gen. Elec. 1M—570 rpm
10° HP., Gen. Elec. 1M—585 rpm. Also 75 HP down

SQUIRREL CAGE & SYN.

300 HP., Gen. Elec., syn, 257 rpm.
250 HP., Burke syn, 360 rpm.
200 HP., Gen. Elec. KT550, 1150 rpm.
100 HP., Westgh., Syn, 900 rpm.
100 HP., Gen. Elec. KT543, 1800 rpm.
100 HP., Elec. Mchy, syn, 300 rpm.
50 HP., Gen. Elec. syn, T87552, 900 rpm. Many smaller sizes

We carry a large stock of all kinds of direct current motors etc. What have you for sale? What do you need?

KEYSTONE POWER PLANT EQUIPMENT CO.

8403 Hegerman St. Phila. 36, Penna.

REDUCED VOLTAGE COMPENSATORS

MANUAL — 220 Volts

Quan.	H.P.	Make	Type
103*	20	G.E.	K1
1	25	West.	—
103*	25	G.E.	K1
76*	30	G.E.	K1
30*	40	G.E.	K1
22*	50	G.E.	K1
1*	60	G.E.	K1
1*	100	G.E.	K33

MANUAL — 440 Volts

50*	20	G.E.	K1
60*	25	G.E.	K1
81*	30	G.E.	K1
31*	40	G.E.	K1
31*	50	G.E.	K1
2*	60	G.E.	K1
1*	75	G.E.	K1
1*	100	G.E.	K1
1*	125	G.E.	K1

MAGNETIC — 220 Volts

Quan.	H.P.	Make	Type
25*	15	G.E.	7051A1A
2*	40	G.E.	7051B1A
2*	50	G.E.	7051B1A
11*	100	G.E.	7051D1P
1	100	West.	11-400

MAGNETIC — 440 Volts

2*	15	West.	11-400
2	20	West.	
1	25	West.	11-400
1*	25	West.	11-400
1*	25	G.E.	7051A1A
1*	200	G.E.	7051D1P
1	200	West.	11-400

MAGNETIC — 550 Volts

3*	20/25	G.E.	7051A1A
1	30	West.	11-400
5*	40	G.E.	7051A1A
5*	50	G.E.	7051A1A
2	50	West.	11-200

MANUAL — 550 Volts

Quan.	H.P.	Make	Type
2	20	G.E.	NR
41*	20/25	G.E.	K1
2	25	G.E.	NR
1	25	G-H	9141
1	30	West.	A
2	30	G.E.	1034
13*	30	G.E.	K1
1	40	West.	E
1	40	G.E.	NR
84*	40	G.E.	K1
1	50	West.	E
1	50	G.E.	NR
84*	50	G.E.	K1
1	60	West.	A
10*	60	G.E.	K1
1	75	West.	A
21*	75	G.E.	K1
1	100	West.	A
26*	100	G.E.	K1
8*	125	G.E.	K1
7*	150	G.E.	K1

*—NEW

ADDITIONAL RATINGS AVAILABLE

SANDMAN Electric

SANDMAN ELECTRIC CO., INC.

165 OLIVER ST., BOSTON 10, MASS.
SALES & SERVICE Tel. HUbbard 2-6750

1000 KW DIESEL GENERATOR SET

G.E., 3 Ph., 60 Cy., 2300 V. Complete with Starting Equipment & Switchboard. Overhauled.

READY TO SHIP

ALJON ELEC. DIESEL CO.
904 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

200'x60"x½" Excellent Steel Stack
125 HP 125# ASME Erie Economic Boiler
3—100 KVA Transformers 13800/460 Volts
20 Ton 60' Span Overhead Travel. Crane
200'x167'x52' Hanger Type Steel Bldg.
690 HP C.B. 750 RPM Marine Full Diesel
40x120' Quonset Bldg. 2 yrs. old

H. & P., 6719 Etzel, St. Louis 14, Mo.

Plymouth 35-ton gasoline locomotive, std. ga.
Nordberg—G.E. diesel—elec. generator set 875 KW.
Cooper Bessemer 1000 HP diesels, rev., new (2).
A-C 625 KW turbo-generator, 440 v., cond.
1000 KW, 300, 200, 150, 100 KW generating sets.
Locomotive cranes, diesel, 30 & 40 tons.
Whirley portal gantry cranes, electric (4).
Crawler cranes, power shovels, diesel (7).
8-Erie 3-ton hydraulic yard type truck-crane.

H. Y. SMITH COMPANY
828 N. Broadway Milwaukee 2, Wis.

---

260 H. P. DIESEL ENGINE

Liquidation Sale—Twin 6—71 General Motors model 12103. Heavy duty reduction gear to 900 R.P.M. With starting batteries and silencers. A standby unit used 4500 hours.

MARTIN J. HANSON TRUSTEE
1500 N. KOSTNER AVE. CHICAGO 51, ILL.

PARTIAL LISTINGS OF EQUIPMENT AVAILABLE FOR YOU

SQUIRREL CAGE, OPEN
3 Phase Motors

HP	RPM	VOLTS	DESCRIPTION
10	720	440	A-C
10	900	220	A-C
10	1200	220	A-C
10	1800	220	Westinghouse
10	3600	220	R. & M.
15	720	220/440	A-C
15	900	220	Howell
15	1200	220	Imperial
15	1800	220/440	G.E.
15	3600	220	G.E.
20	600	220	G.E.
20	900	440	A-C
20	1200	440	A-C
20	1800	220/440	G.E.
20	3000	440	A-C
25	600	440	G.E.
25	720	220	Westinghouse
25	900	440	G.E.
25	1200	220	Century
25	3600	220/440	L-A
30	514	440	Stanley
30	720	220	G.E.
30	900	220	A-C
30	1800	220/440	L-A
35	600	440	G.E.
40	720	440	G.E.
40	900	440	G.E.
50	720	2200	Westinghouse
60	1800	2200	G.E.
60	3600	2200	G.E.
75	1200	220/440	G.E.
85	3600	2300	G.E.
100	720	440	Westinghouse
100	1800	2200	Westinghouse
115	1200	440	G.E.
125	1200	550	G.E.
125	1800	2200	A-C
125	3600	220/440	A-C
150	1800	440	Howell
225	514	440	G.E.
250	600	2300	Triumph
300	900	440	G.E.
350	3600	2200	Westinghouse
750	900	6600	Westinghouse

* New Motors

SPECIALS

NEW DIESEL

Murphy ME650—165 HP, 1200 RPM 6 cylinder, 5¾ bore, 6½ stroke, complete. Will furnish engine only or as AC or DC Engine-Generator Set.

RECTIFIERS

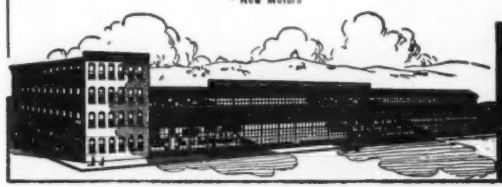
General Electric Copper Oxide with output 500 amp., 6 volts, D.C. and designed to operate on 440 volts, 60 cycle A.C. power. Units may be operated in multiple.

MOTOR GENERATOR SETS

D.C. OUTPUT			A.C. INPUT		
KW	Voltage	Description	HP	RPM	Volts
1	115	G. E.	1½	1800	220/440
1.15	115	Watts	2	1800	220
5	230	Westgh.	7½	1200	440
7½	125	Westgh.	10	1200	220
10	250	Westgh.	15	1800	220/440
12½	230	Westgh.	19½	1800	220
20	115	G.E.-Al. Ch.	30	900	220
22	125	Al. Ch.	33½	900	220
47½	125	Al. Ch.	100	1200	2300
50	125	C.-W.	85	1800	440
50	250	Al.Ch.-Westgh.	75	1200	220
75	125	G.E.	115	1200	440
100	250	Westgh.	147	1200	4300
200	250	G.E.-Westgh.	300	1200	440
300	250	G.E.	450	1200	2300
400	250	Westgh.-G.E.	600	1200	220/440
750	500	Westgh.	1070	900	13200
800	400/800	Westgh.	1200	1200	2300

ALTERNATING CURRENT GENERATORS

KVA	RPM	VOLTS	DESCRIPTION
12½	1800	440	Electric-Specialty-BB
18.75	1200	120-240	G.E.-1 ph.
20	1800	2300	Fairbanks-Morse
25	1200	120	Westgh.-1 ph.
31	1800	120-208	Westgh.
37*	1200	120-208	Westgh.-sgle. brg.
50	1200	240-480	Delco-sgle. brg.
50	1200	240-480	Delco-two bearing
75	1200	240-480	Delco-sgle. brg.
94	1200	600	Westgh.-sgle. brg.
125	900	2300	Allis-Chalmers-BB
125	1200	220	Westinghouse
200	164	440	G.E.-2 ped brgs.
200	200	240	G.E.-no shaft or brgs.
250	1800	4160	G.E.
610	000	12000	G.E.



GLOW ELECTRIC CO.
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

BOILERS—TURBINES

1—Erie City—3 drum, bent tube water tube boilers, 1940, rated 29,000# steam per hour, each, can produce 42,000# steam per hour each, with water walls. Rated 500 HP each at 250# steam pressure, complete with oil burners and trim.

1—Combustion Engineering, 3 drum, bent tube, low head, water tube boiler, 1943. Rated 20,000# steam per hour, 400 HP at 185# steam pressure, complete with stoker and controls, valves etc.

1—Unused 140,000# per hour Combustion Engineering Steam Generator, V U Type, 450# steam pressure.

Also:

2—750 HP B & W straight tube boilers, 225# to be released soon.
3—600 HP B & W straight tube boilers, 200# to be released soon.
Various package units from 25 HP to 500 HP various pressures.

We also carry power and distribution transformers, switch gear, including potential and current transformers, circuit breakers etc.; also steam turbines, all sizes and pressures.

WE BUY ENTIRE CENTRAL AND POWER STATIONS

HOWE BROTHERS

342 MADISON AVENUE **MUrray Hill 2-8562** **NEW YORK 17, N. Y.**

We Offer PRESSURE VESSELS FOR SHIPMENT NOW

USED CONDITION
CODE CONSTRUCTED BY
A. O. SMITH CORP.

8—10' ID dia. x 40' tangent to tangent x 3" shell. Heads 3½". Test pressure—900 psi. WP—600 psi. All-weld.

8—10' ID dia. x 40' tangent to tangent x 2½" shell. Heads 3". Test Pressure—750 psi. WP—500 psi. All-weld.

2—8' ID dia. x 40' tangent to tangent x 1½" shell. Heads—1¾". Test pressure 575 psi. WP—380 psi. All-weld.

8—8' ID dia. x 40' tangent to tangent x 2" shell. Heads 2¼". Test Pressure 750 psi. WP—500 psi. All-weld.

All vessels located near Chicago, Illinois, and offered subject to prior sale.

Write—Wire or Phone
Howard Kinslow

Kinslow Power & Equipment, Inc.

817 So. Boulder **Tulsa 14, Okla.**
Phone 5-5914

FOR SALE

by
CENTRAL HEATING COMPANY
V. MAX FREY, TREASURER
37 W. Market St., York, Pa.
Telephone 66-66

1—ADSCO Horizontal Instantaneous HOT WATER HEATER. Water in SHELL, Steam in Tubes. 579 square feet—1½ O.D., #16 B W G Copper U Bends, Tubes.
WEIGHT—3200#
WORKING PRESSURE—75#. Tested to 150#. Will pass State of Pennsylvania Inspection.
30" over-all diameter x 8'9" over-all length—TYPE R
This HEATER will Heat approximately 20,000 Gallons of Water per hour.
MANUFACTURED BY American District Steam Company, Inc., North Tonawanda, N. Y.
This HEATER was purchased to supply Hot Water for a Hot Water Heating System in a large Building containing 40,000 square feet of Radiation. It was AMPLY LARGE for the purpose.
Steam for Heating the Water entered the Heater at 5 lbs. Pressure
IT COST NEW in June 1946 (less than five years old)—$1700.00
SALE PRICE—$1100.00 f.o.b. Hanover, Pa.
This HEATER is for Sale only because the Building which it Heated was changed over to Steam Coil Fan Heat, April 1st, 1950. This HEATER was Amply Large to Heat the Building with Hot Water with Steam purchased from Central Heating Plant, which arrived at the Building at 5 pounds Pressure.

MONOHAIL HOIST COMPLETE

4 ton bucket hoist—3 motor high speed, with 2-4 wheel swivel trucks and Williams standpace bucket with safety catches
Coke Bucket
Hoisting Cables

SPARE PARTS FOR HOIST

40 H.P. 440 volt 3 phase motor
30 H.P. 440 volt 3 phase motor
Torque motor 440 volt
Miscellaneous small parts

Available Immediately
Contact Gas Superintendent

WISCONSIN MICHIGAN POWER COMPANY
APPLETON, WISCONSIN

This Seal JLHCo ...tells you what you buy is GOOD EQUIPMENT!

GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1500	Whse.	Hipersil	3	66000/33000 prt., 240/480 sec. w/Taps
1	1500	GE	Pyranol	3	4150x2300Y
1	500	Kuhl	OISC	1	4600x2300Y
3	400	GE	H	1	6900x2250Y
1	300	Pitts.	ODSC	1	7800x440Y
1	200	GE	WT	3	2300x220
1	200	Whse.	Auto	3/2	4150x2300
1	200	Pitts.	OISC	1	4800x110/220
1	200	GE	Auto	3/2	4150x2400
1	150	GE	ES	1	2300x230
2	100	Pitts.		1	2750x110/220
3	100	Wagner	RCKV	1	240x120/120
2	100	Whse.	SK	1	4400x220/440 Taps

SPECIAL—WELDING MOTOR GENERATOR SET

1—178 KVA Whse. Welding Gen. Set, 1 Ph. 20V. 800 Amp 57% PF with Slip Ring Motor & Exciter

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	GE	514	600	2300/4150 Syn.
1	500	GE	1200	250	2300 Syn.
1	200	Whse	900	250	220/440 Syn.
1	150	GE	1200	125/250	2300 Syn.
1	150	Whse	900	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El. Mach	1200	125	4150 Syn.
1	94	GE	1200	60	440 SC
3	94	GE	1200	60	4150 Syn.
1	75	Cr. Wh.	1200	250	4150/2300 syn.
2	40	El. Mach.	1750	125	440 SC

SYNCHRONOUS

300 HP El. Mach. 720 RPM 2300 V T.E.F. C. outdoor Service

200/100 HP Whse. 720/360 RPM 4150 V.

SLIP RING

1	2500	GE	MT	6600	257
1	250	Whse.	CW	440	600
1	200	GE	MT	2300	1800
1	200	Whse.	CW	440	600
1	200	GE	MT	440	600
1	100	GE	TM	440	400
1	75	GE	MT	220	1200 Vert
1	60	Wh.	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200

"FOR POWER"
J.L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 7-2600

Member of The National Industrial Service Association, Inc.

STEAM ENGINE GENERATOR UNIT

1—Erie City Lentz Patent, Serial No. 23750 25½" x 30"—10' x 2' flywheel, left hand crank, 150 RPM engine complete with 9" throttle, throttle receiver and lubricators. Designed to develop 500 KW with 160 PSIG saturated steam at 6 PSIG back-pressure.

Shaft connected to a G.E., Type ATB-48-150 Form "E" 500 KW, 2300V, .8 P.F., 60 Cycle, 625 KVA continuous at 50° rise generator, Serial #2500580.

A complete complement of instruments, and breakers mounted on a 4'2" x 6' panel is available.

F.O.B. Cars. In Operating Condition.....$15,000.00

PORTER ELECTRIC COMPANY
116 Third Avenue North, Minneapolis 1, Minnesota Lincoln 7531
TRY PORTER FIRST

FOR SALE: New Equipment

2—Bronze Cent. Pumps, 6"x5", 1000 GPM—280' hd. Allis-Chalmers
22—¾" Browne & Sharpe geared pumps, direct mounted on ¾ HP, back geared motors, 316 RPM, 3 ph.
1—Amer. Well Works Pump, with 50 HP Motor 3 ph.
1—Worthington Monobloc, 20 HP, 3 ph.
2—Worthington Monobloc, 10 HP, 3 ph.
1—Deming, with 15 HP, Motor, 3 ph.
1—25 HP, G.E. Exp. Proof Motor, 3 ph. 1750
10—7½ HP, C.W. motors, 3500 R.P.M. 3 ph.
1—Large Blower, STAINLESS STEEL HOUSING & BLADE. 25" dia. inlet.
Large quantity of rebuilt Elec. & Steam Pumps.
Stainless Steel, cast steel and iron Valves & Fittings.

VALVE AND SUPPLY CO.
378 Bedford Ave., Brooklyn 11, N. Y.

TRANSFORMERS—60 cycle

2—1250 KVA, A. Ch., 4800/460—3 ϕ
2—1250 KVA, A. Ch., 4160/460—3 ϕ
1—2500 KVA, A. Ch., 4800/460—3 ϕ
1—2500 KVA, A. Ch., 4160/460—3 ϕ
1— 667 KVA, A. Ch., 4160/460—3 ϕ
3—1250 KVA, G. E., 13200/440—1 ϕ
3—1250 KVA, G. E., 13800/440—1 ϕ
3—1250 KVA, G. E., 7200/12470Y/440 1 ϕ
2— 750 KVA, Gen. E., 11000/480; 3 ϕ, 25 cycle
1— 500 KVA, Scott Bank 2200, 3ϕ—pri. 220/440 2 ϕ
1— 100 KVA, Wagner, 480/120/240—1 ϕ
1— 325 KVA, Furn. 2300/4600/125—1 ϕ
1— 100 KVA, A. Ch., Furn. 440/110/80/60—1 ϕ
3— 75 KVA, A. Ch., 33000/2300/4160—1 ϕ WH. SW. GR.
2—75 KVA Gen. Elec. type H, OISC, 4160/4600, 230/460, 1 Phase
3—50 KVA Kuhlman OISC, 11,000 V. Pri., 120/240/480 V. Sec. 1 Ph.
6—25 KVA, Kuhlman OISC, 2300/4600 Pri., 115/230 Sec. 1 Ph.

M.G. SETS

1000 KW, A. Ch. 250 V. DC, 1400 HP, 3 ϕ, 25 cycle. Or will consider changing motor for 60 cycle. Complete with switchgear.
200 KW, A. Ch., 125 v. D.C.; Mtr. 300 HP 3/30
40 KW—1000 amp., 40 V—DC mtr, 7 SHP 3/60
60 KW—1500 amp., 40 V—DC, mtr. 100 HP 3/60
100 KW, 125 volt D.C. mtr. 150 HP, 3/60
30 KW, 125 V D.C. mtr. 50 HP 3/60

FREQUENCY CHANGERS:

KVA—465 25/60 cy. or 60/25—3 ϕ RPM 300 Motor 650 HP, 3 ϕ, 300 RPM with sw. gear
1—200 KVA Gen. Elec. 25 cyle to 62½ cycle, 750 RPM, Motor 300 HP, 25 cycle, complete with panels
1—120 KW, 25/62½ cycle, 3 ϕ 720 RPM. Motor 200 HP 3/25/720 RPM
3— 20 KVA, G.E., 60/180 cycles 3 ϕ
3— 30 KVA, G.E., 60/180 cycle 3 ϕ
3— 25 KVA, G.E., 60/120 cycle 3 ϕ
1— 15 KVA, G.E., 60/120 cycle 3 ϕ

SQUIRREL CAGE MOTORS
3 phase, 60 cycle

HP	Make	Type	RPM	Volts
150	G.E.	IK14	1700	2300
100	A. Ch.	S.C.	690	440/550
100	G.E.	IK17	400	220/440/2300
150	G.E.	IK17	514	220/440/2300
75	G.E.	IM S R	600	220/440/2300
75	G.E.	IK	400	220/440/2300
75	West	CW S R	1200	2300/440/220
50	A. Ch.	ANY SR	900	220/440
40	Star	BB S R	900	220/440
40	G.E.	IK	900	220/440
100	G.E.	IK	1800	220/440
200	G.E.	KT 25 cyc.	750	220/440
200	West.	CS 25 cyc.	750	220/440
150	C. Wh.	25 cycle	480	2300/440/220

1—G.E. 3 pole switchgear 3700 volt 400 amp.
1—400 amp. 3 pole 15000 volt breaker G.E. FK132A

VOLLAND ELECTRIC EQUIPMENT CO., INC.
Subsidiary Co.—Buffalo Transformer Co.
1500 NIAGARA ST. BUFFALO 13, NEW YORK

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873C	2200	1160
1	200	Al.Ch.	AR	440/220	580
2	125	Al.Ch.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-683C	440/220	1750
1	100	G.E.	IK	440/220	1800
1	100	Al.Ch.	AR	2200	1160
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H2418	440/220	435
1	100	Whse.	CS-938	2300	495
1	75	G.E.	I-K15	440/220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690
1	50	G.E.	IK	440/220	1160

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	2000	Whse.	80	4800/2400	720
1	700	G.E.	80	2300	720
1	600	Whse	80	2400	720
1	400	Whse	80	440	600
1	300	Whse	80	440	514
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	3000	G.E.	MT	2200	356
1**	1200	C.W.	8K	2200	237
2**	1000	Al.Ch.	ANY	2200	238
1**	600	G.E.	MT-20	2200	360
1**	400	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
2	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	Al.Ch.	ANY	2200	514
1	250	Al.Ch.	ANY	440	585
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2300	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	1M	440/220	695
1	75	Whse.	CW-7540	440/220	690

**Mill type pedestal bearing. ***3 bearing.

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch.	720	525	4800/2400
1	2400(3-U)	Whse.	720	600	4800/2400
1	1500	Whse.	514	250	4600/2300
1	1000	G.E.	514	550	2300
1	500	C.W.	720	250/275	2300/440
2	500	C.W.	720	575	2300/440
1	250	Whse.	1200	125/250	2300
1	200	Ridge-way	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	C.W.	1200	125	440/220
1	100	Delco	1200	125/250	440/220
1	100	Ridge-way	1200	275	4000/2300
1	85	C.W.	1200	250	2300/440
1	75	Star	1200	250	440/220
1	75	Al.Ch.	900	250	2300
1	75	Whse.	900	75	2200
1	25	Ideal	1750	125	220
1	20	Al.Ch.	1200	250	440/220
2	15	Al.Ch.	1200	250	440/220
1	15	G.E.	1750	250	440/220
1	10	Whse.	1200	250	440/220

3-U — 3-unit set.

We can furnish any of the above sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt for your requirements.

TRANSFORMER — Power

Qu	KVA	Make	Type	Phase	Voltage
1	2760	G.E.	DH	3	6900-240/480
3	500	Whse.	S	1	13800-2400
4	333	G.E.	H	1	13200/11000-2200
3	250	Packard	A	1	13200-2200
3	150	G.E.	H	1	19000/9500-550/2200
3	100	G.E.	H	1	33000-2300
3	100	Whse	SS	1	12075/10955-230/460
3	50	Al.Ch.	O.I.S.C.	1	22000-220

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-109	1150
1	325	Whse.	QM-600.6	450-900
1	200/250	El.Dy.	#22	400/120
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	300	Whse.		240/300
1	180	G.E.	MPC	400
2*	150	C.W.	83-H	890
1***	125	Whse.	8K-190	600
2	125	Whse	8K-184	575/850
1	100/125	Rei	1095-F	300/1200
2	100	Rei	1050-T	400/1200
1	90/160	G.E.	MPC	625/1125
1*	50/75	Rei	1095-F	300/1200
1	35	G.E.	RF-14	500/1500
1	35	G.E.	CD-125	400/1200
1	35	G.E.	CD-147	300/1200
1	35	Rei.	85P	250/1000
1	32½	Whse.	8K-150	400/1200
1½	30/75	Whse.	8K-151L	400/1200
1	30	Al.Ch.	E-145	400/1200
1	30	G.E.	CDM-105	875/1750
2	27½	El.Dy.	158	450/1350
1	25	G.E.	RF-13	400/1600

All above 230-VDC except where marked ***
*** Pedestal bearing mill design 525, 600-VDC (Rev.) Designed for mill reversing service.
* T.E.F.C.

T. B. MAC CABE COMPANY

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1—Range 0—1000 C
1—Range 0—1200 C

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2—4000 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4000 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 200# N.C.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 200# N.C.
2—1000 KW, 480 V., 180# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 500 KW, 2300 V., 165# Cond.
1— 300 KW, 2300 V., 150# Cond.
1— 150 KW, 2400 V., 150# N.C.

ENGINE GENERATORS

1—600 KW, 1380 V., Unit.
1—500 KW, 230 V., D.C., Unit.
3—375 KVA, 550 V., Unit.
1—312 KVA, 440 V., Unit.

DIESEL GENERATORS

1—1000 KVA, 2400 V.
3— 540 KW, 480 V.

BOILERS

1—30,000#, 425#
1— 1,000 HP, 250#
2— 500 HP, 200#
1— 438 HP, 200#
2— 300 HP, 250#
2— 250 HP, 200#
6— 150 Hp, 150# Sc. Mr.
1— 78" H.R.T., 200#

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2—(Same as above) equipped for gasoline.

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1000 KW GE MERCURY ARC RECTIFIERS (3)

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270/280 V. DC Booster Type 1200 RPM Six Ph. Ped. Bear. Manual Control, Trans. to suit.

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Diesel Engine & Generator Sets

1—375 HP Worthington, 200 KW, GE Gen.
1—180 HP Worthington, 120 KW, GE Gen.
1— 45 HP GM Engine Gen. Set.
Switch Gear, Panel & Auxiliary Equip.

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DIESEL GENERATOR UNITS

AC and DC

Quick Delivery and Complete Installation with all Equipment

LIEFKE, 57-25 Cooper Ave.
Brooklyn 27, N. Y. — HEgeman 3-4335

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2300	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
250	440	G.E.	600
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/100	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HB	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Wyn.	600
240	2200/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/8 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp, G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampers, Whse., 3 pole, 600 v., air
1—400 amp., 37000 V., G.E., Type FMKO-236 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G.E.	IK	720
250	2200	Al. Chal	AR	1900
200	2200	G.E.	K	200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
150	440	multi sp.	KT	1800/600
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 440 V., Whse.
1—150 kva, 900 rpm, 480/240 v., G.E.
1—100 kva, 720 rpm, 440 V., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230 (2)	Whse.	SK	850
100	230	Cr. Wh.	CMC	625
100	250	G.E.	CD	1750
75	230	G.E.	CD	1130
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—230 kw, 1200 rpm, 240 V., Whse., conn. to 350 hp, 2200 V., sq. cage.
1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—75/90 kw, 250 V., 1200 rpm, G.E. conn. to 135 hp, 440/220 V., sq. cage.
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2700/400 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage.

TRANSFORMERS 60 CY.

3—500 kva, G.E., 4000—2300 V.
3—333 kva, G.E., 13,200—2300 V.
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3—300 kva, Whse., 12200—440 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
3—250 kva, Whse., 2300—208 V.
3—200 kva, G.E., 13200—460/230 V.
3—200 kva, Whse., 2400—240/120 V.
3— 75 kva, Moloney, 4150—240 V.
1—150 kva, Whse., 2400—240/480 V. (Pyranol)
6—100 kva, Whse., 2400—120/240 V.
6—100 kva, G.E., 4156—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
1—150 kva, Whse., SK, 13200-125/215 v., 3 ph.
3— 75 kva, Whse., 2400—240/480 V.
6— 50 kva, G.E., 2400—120/240 V.

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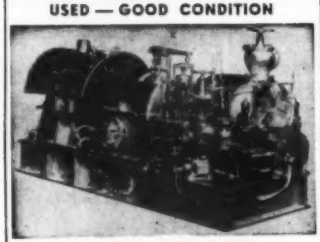

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132 KW, 200 KW,
500 KW, 3/60/450 AC

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WESTINGHOUSE

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Union Iron Works Horizontal Straight Tube

2—259 H.P., single drum

2—350 H.P., two drum

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COMPLETE DIRECT DRIVE DIESEL POWER PLANT, with 50 KVA electric generator belted to drive shaft.

DIESEL EQUIPMENT: one 112½ HP engine and complete supplementary equipment, including a 12,000 gal. fuel oil storage tank, to make a complete operating installation.

GENERATING EQUIPMENT: one 50 KVA generator, one dc generator, switchboard panel and instruments and voltage regulator.

PRICE: All, loaded on cars, fob Greensburg, $5,500.00.

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GREENSBURG INDIANA
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200 H.P. B. & W. 160# Boiler, 1931.
225 H.P. B. & W. 160# Waterwall, Boiler 1949.
(2) 215 CFM 4016 Penn. Air Comp.
(5) 14"x20' Frick Dehydrators.
(3) 30"x16' Amm. Condensers (1) Receiver.
6 Ton S.N. double transfer Crane.
(1440) 300# Galv Ice Cans, Air tubes.
(2) Slat Conveyors (25 ft) (75 ft).
(4) 4696 sq ft Frick Vertiflow Coil units.
(4) 3 H.P. Vert. Brine Agitators.
160 Ton Vilter Elec. Amm. Comp.
80 Ton H. & C. Steam Amm. Comp.
Amm. Accumulators, Misc Valves & Fittings.
(24) 300# Galv Can fillers.
Perfection Scoring Machine, Ice Stacker.
1500 G.P.H. Coch. IJS H.P. water Softener.

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50 KW Int'l Harvester set, AC, Model UD-14, 4 Cyl., 3.60/120/208 V.
60 KW General Motors set, Model 6-71, 6 cyl., 3.60/120/208 V., 1200 RPM.
Rebuilt. Immediate delivery.
Other sizes in stock, AC & DC Units
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ELECTRICAL CABLE

- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

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UNUSED CENTRIFUGAL PUMPS

3 Goulds 2" Fig. 3769 centrifugal pumps, 300 GPM at 70 ft. head at 1750 RPM. Bases and couplings for direct motor drive included. (Pumps in storage Jersey City.)

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POWER EQUIPMENT—READY TO SHIP

IMMEDIATE DELIVERY
AIR COMPRESSOR

1000 cfm Chicago Pneumatic 100# pressure 2300 or 440 v, A.C. syn. motor. Complete with starter and all accessories.

A.C. MOTORS
220/440 v. 3 ph. 60 cy.

HP	Make	RPM	Type
1000	Elec. Mach.	1200	syn.
500 New	Allis-Chal.	1750	drip proof
375	Westg	2300	v.
250	G.E.	515	tefc. bb
250	Burke	720	syn.
250	G.E	1200	I-E
250	G.E	1200	2300 v.
225 syn.	Elec. Mach.	1800	2300 v.
225	Elec. Mach.	1800	syn.
200	Westg.	291	CS
200	G.E.	430	tefc.
200	G.E.	900	2300 v.
200 (4)	Wagner	1750	RP-2
200	G.E.	1800	(2200 v.) syn.

SLIP RING MOTORS
3 Phase—60 Cycle

HP	Make	RPM	Volts
450	Allis-Chal.	293	2200
400	West.	438	2200
300	Cr.-Wh.	290	2200
200	West.	500	220/440
200	West.	500	2200
150	G.E.	600	2200
150	West.	870	2200
150	West.	870	220/440
100	Triumph	580	550/440/220
75	G.E.	600	550/440/220

CLEANING MILL

1—Ransohoff Cleaning Mill 48" x 72", side loading side unloading, star return, with sand handling conveyor complete with tank, pump and motors.

SPECIAL BARGAINS
Diesel Engine Generator Sets

2—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 250 HP Model 6BD-8, 5½x7, 8 cyl. Superior DIESEL Engines, elec. start with engine panels.
2—100 KW same as above with 220 or 440 v. NEW A.C. Generators.
10—37½ kva. 3 ph 60 cy. 127/220 v. or 220/440 v. 1200 rpm., Century A.C. Generators with dir. con. exciters driven by 70 HP., 4 cyl. Model UD-14 International Harvester DIESEL Engines with panels.
1—37½ kva., 3 ph. 60 cy. 127/220 v. or 220/440 v. Century 1800 rpm., dir. con. exciter driven by 72 HP., Model 6DTG317, Buda Diesel Engine with panel.
1—60 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 900 rpm DIESEL.
4—25 kva. 120 v. 1 ph. 60 cy. Westinghouse dir. con. to 38 HP., 4 cyl. 900 rpm., LeRoi Gasoline Engines with control panels.
8—25 kw., 220/440 v. 3 ph. 60 cy. Westinghouse direct connected to 4 cyl. LeRoi Gasoline valve in head liquid cooled Engine complete with control panels.

VARIABLE SPEED MOTORS
230 Volt DC

HP	RPM	Make	Type
100	500/1000	West.	SK-190
100	625/1250	West.	—
50	750/1500	West.	SK-150
40	250/1000	West.	SK-141L
50	300/1200	Cr.-Wh.	CMC
40	385/1200	Elec. Mchy.	—
40	750/1500	West.	SK-140
40	575/1150	Al.-Chal.	E-145
30	725/1450	West.	SK-130
25	500/1500	West.	SK-110L
25	360/1200	G.E.	CD-123

ELECTRIC MACHINERY FREQUENCY CHANGER SET

600 KW Motor Generator Set consisting of 1000 KW, syn motor 440/3/60 1200 rpm, and 1—750 KVA 440 V. 3 Ph. 180 cycles 1200 rpm, 80% P.F., complete with exciter and automatic control switch gear. EXCELLENT CONDITION.

MOTOR GENERATOR SETS

150 KW, Crocker Wheeler, 250 V. DC, 1750 RPM, 2300 or 220/440 Volt Ind.
100 KW, Hobart, 250 Volt, 2200 Volt, 3 Phase, 60 Cycle, 1750 RPM Ind.
50 KW, West., 250 Volt DC, 1150 RPM, 220/440 Volt AC.

NEW ENGINES

75 HP, P&H, full Diesel, Model 387C, 1400 RPM, heavy duty, 3 Cylinder.
138 HP, P&H, 6 Cylinder, full Diesel, Model 687C, 1400 RPM, heavy duty.

230 Volt DC Motors

HP	Make	Type	RPM
600	Cr.-Wh.	CCM	300/330
400	Cr.-Wh.	CCD	200
400	West.	—	300
100	Cr.-Wh.	CMC	1200
100	West.	SK-100	500
100	West.	SK-142L	1700
60	West.	SK-153	850
60	West.	SK-122L	1750

250 Volt DC Generators

KW	Make	Type	RPM
500	Cr.-Wh.	CCM	375
375	West.	—	400
150	Burke	B-70	900
150	Cr.-Wh.	CMC	1450
100	West.	SK-100	720
100	Al.-Chal.	—	275
100	Delco	120/240	1200

TRANSFORMERS
1 ph. 60 cy.

Ns.	Kva	Make	Primary	Sec.
3	200	Pgh.	2200	2200
2	150	Pgh.	4800	115/230
1	110	Pgh.	4600	115/230
6	100	Pgh.	4600	115/230
2	100	Allis-Chal.	4800	120/240
2	100	G.E.	4800	120/240
1	75	Pgh.	4800	115/230

BAKER LOCOMOTIVE CRANE TRUCK

Model CTA 3000 lbs. at 7' radius with 8 to 12' adjustable telescoping boom complete with slow control, hoist control and boom control.

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Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

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BOILERS

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B&W Boilers—300 and 500 H.P., 200 lbs.
Erie City Economics—125, 170, and 200 H.P.
Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

BOILER & EQUIPMENT CO.

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MOTORS!! PUMPS!! TRANSFORMERS!!

4—1000 KVA Amer. Brown Bovari 33000 PSI, 2400/4160Y Sec. volts transformers
1—200 HP, 600 RPM, GE, Slipring IM, Frame 17, 3/60/220/440
1—150 HP, 514 RPM, Westinghouse Slipring, Type HF, 3/60/220/440
3—75 HP, 900 RPM, Westinghouse Squirrel Cage, Type CS, Frame 753C, 3/60/220/440
1—1000 KVA—AC Generator Westinghouse, 3/60/2300 V., 720 RPM
1—1000 KVA Synchronous Condenser, 3/60/2300 4000, 600 RPM
2—24x24 Dayton Dowel CS24, 16,500 GPM, 18.5/35 FT. HD., 360/450 RPM

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BENSON-WILIMZIG, INC.

formerly C & S Machinery Co.
1708 N. 8th St. St. Louis, Mo.
GA-4290

TRANSFORMERS
FOR SALE

1 Phase, 60 Cycle

3—500 KVA G-E 66000—2300
2—500 KVA W-H 13200—240/480
3—400 KVA W-H 13200—600/575/550
3—333 KVA G-E 44000—6600
3—250 KVA W-H 13800—2300
3—200 KVA G-E 13200—120/240
3—150 KVA G-E 44000—33000—2400/500
3—100 KVA G-E 33000—6900/11950Y
3— 50 KVA A-Ch 33000—2400/4160Y

3-Phase, 60 Cycle

2— 750 KVA W-H 13800—460 DRY
1—4000 KVA W-H 1500/12750 Auto

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

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1,250 KVA Westg. condensing extraction, 150-200 lbs., 600° FTT, 5-25 lbs. extraction, 480 volts.

625 KVA Westg. non-condensing, 150-200 lbs., 600° FTT, 5-25 lbs. exhaust, 480 volts.

UNIFLOW UNITS

3 Phase 60 Cycle

2,500 KVA Nordberg-Westg. 250 lbs. steam, 20 lbs. exhaust, 2400 volts.

UNIFLOW UNITS (Con't.)

3 Phase 60 Cycle

750 KVA Ames-Allis-Chalmers vertical, 150 lbs. steam, 5 lbs. exhaust, 2400/4160 volts.

625 KVA Skinner-G.E., 150 lbs. steam, 5 lbs. exhaust, 240 volts.

312 KVA Skinner-G.E., 150 lbs. steam, 3 lbs. exhaust, 480/240 volts.

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1,250 KVA (2) General Motors 2300 volts, 720 RPM.

875 KVA De LaVergne, 2400/4160 volts, 327 RPM.

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40 HP GE MT346 3/60/220V/900/#4012815
50 HP West. CW 3/60/220V/1175/#2249566
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100 HP GE I-16 3/60/220V/430/Type I-16/#1578089
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24-GE 1500 Amp. Synch. driven w/AC & DC Panels

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TURBINE GENERATORS—M-G SETS

4-New Hercules 135 HP Mod. DWXD
250 KVA Elliott Turbo Gen. 3/60/208V/1200 RPM
150 KW GE 3 Brg. Syn. 3/60/220V/1200/240 V/DC
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1—200 KW Buckeye AC 3/60/2200V/360 RPM
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220 or 440 Volts

Qu.	HP	MFR.	Type	Speed
1	15	A.C.	AR	1200
1	15	G.E.	I	900
1	15	Whse.	CS	720
1	15	G.E.	IK	720
1	20	G.E.	KF	1800
1	20	Wag.	15VRP	1200
1	20	G.E.	KT	1200
1	25	G.E.	KT	1800
1	25	G.E.	KF	1800
1	25	G.E.	IK	1200
2	25	G.E.	KT	900
1	25	G.E.	K	900
1	25	G.E.	IK	600
1	30	Whse.	CS	1200
4	30	F.M.	H	1200
1	30	G.E.	KT	900
1	30	W.E.	CS13B	720
1	35	G.E.	IK	1800
6	35	A.C.	AR	450
1	40	Whse.	CS	1200
1	40	Whse.	CCL	600
1	50	G.E.	KT	1200
1	50	A.C.		900
2	50	Whse.	CCL	600
1	75	Whse.	C	600
1	150	F.M.	O	1800

SLIPRING

1	1½	G.E.	M	1080
1	15	G.E.	ITC	815
1	20	G.E.	MT	1200
1	150	Whse.	CW	1800
1	200	A.C.	ANY	1800

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Canton & Hawkins Sts., Dallas 1, Texas

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5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.

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1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.

1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1—1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.

1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.

1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.

7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.

1—Kennecott Pressure Type Industrial Water Filter.

1—50-Ton Electric Traveling Crane—55'5½" Span.

1—25-Ton Hand Operated Traveling Crane—57' Span.

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2500 HP SLIP RING MOTOR

GE MT 3/60/6600 257 RPM Roller Bear. 2 Ped. #5283052 2 Cir. Delta. Excellent Condition.

2100 HP SYNCHRONOUS MOTORS

GE ATI 3/60/2300 360 RPM 1 PF Ped. Rod. V. Panel.

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261 H.P. Farrar & Trefts 1943—125#, series 500 with Detroit stoker.

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STEAM TURBINE

One 1250 KW Steam driven turbo - generating set, complete with surface condenser, air ejector, circulating and condensate pumps with driving motors and controls.

Turbine Steam Consumption 200#/hr

100° F. superheat steam at throttle

1250 KW 14.92# steam/KW hr. at .8 P.F.

2300 Volts 3600 RPM

CIRCULATING PUMP

12000 GPM for 25' Head, 580 RPM.

Three Spray Type

DEAERATING HEATERS

64,000# per hour

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25 cy. 60 cy. D.C.

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BOUGHT and SOLD
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ROCHESTER 1, N. Y.

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60 Cy. Single and 3 Phase

KVA	Make	Pri. Volts	Sec. Volts
		—Voltages—	
2500(3)		27600	2300
2000(3)		45000	2300
1500	GE	2200	600
1500(5)	Pitts.	33000	2400
1000(4)	Am.	33000	2300/4000Y
1000	GE	66000	7200/7025
1000	West.	2200	220
833(2)	GE	13800	460
750	GE	2300	2.3 ph. 2300
750(4)	GE	2200	244/488
750(1)	West.	13800	460
667(3)		6900	230/460
667(3)	GE	13200	2300/4000
667(3)	GE	13200	2300
667(3)	Davis	6600	2300/4000
500(1)	Mol.	13800	230/115
500(2)	GE	11000	2300
500		4600	460
500	GE	34500	230/460
480(11)	GE	22000	190
480(3)	West.	22000	190
450	Uptegraff	11000	460
450(1)	Uptegraff	11000	230
400(2)		2300	3 ph. 230
400(3)	Wag.	2300	440/220
333(1)	GE	22000	2200
333(3)	GE	22000	2200
333(1)	GE	22000	2300
333(2)	GE	11500	115/230
333(3)	GE	11000	2200
333(3)	GE	4150	120/240/480
300(3)	West.	14520	550/230
300(1)	Pitts.	6600	110
300(3)	Pitts.	2300	115/230
250(3)	GE	4830	2300
250(3)	GE	4830/8365Y	2300
250(1)	GE	2400	240/480
250(1)	Wag.	2200	440
250	West.	463	
200	Moloney	600	220/110
200	West.	13200	2300
200	GE	4156	240/120
200	GE	495	120/240
200	GE	2200	122/244
200	Penn.	2400	480
200	Moloney	2400	230/460
200	West.	2300	600
200	Pitts.	2300	600
200	GE	11500	460
200	West.	3984	115/230
200	GE	6900	2400
150	Packard	4600	230/115
150	GE	2400	240/480
150	Pitts.	13200	2300
150	GE	2400	600
150	Standard	2300	230/460
150	GE	13800	115/230
150	West.	2400	240/480
150	GE	2400	240/480
150	GE	2200	110/220
150	Pitts.	7200	115/230
150	GE	4150	120/240
125	West.	440	440
125	West.	440	440
125	Al. Ch.	440	220/110
100	Pitts.	4600	230/115
100	Al. Ch.	6600	2300
100	Pitts.	13200	6900/11950Y
100	Uptegraff	4160	40
100	Pitts.	2100	110/220
100	Wagner	3980	115/230
100	West.	13200	220/440
100	Moloney	2200	110/220
100	GE	460	115/230
100	GE	18490	2400/4800
100	GE	11500	230/460
100		4600	2301
100	GE	11000	2300
100	GE	6900	2400/4160Y
100	GE	4160	240/120
100	GE	2400	120/240
100	Pitts.	2300	115/230
75	Pitts.	2400	120/240
75	Packard	460	150/230
75	GE	2400	600

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— World's Largest Inventory —
We Stock 1200 Units 5 to 75 KVA

ELECTRIC EQUIPMENT COMPANY

ROCHESTER, N. Y.

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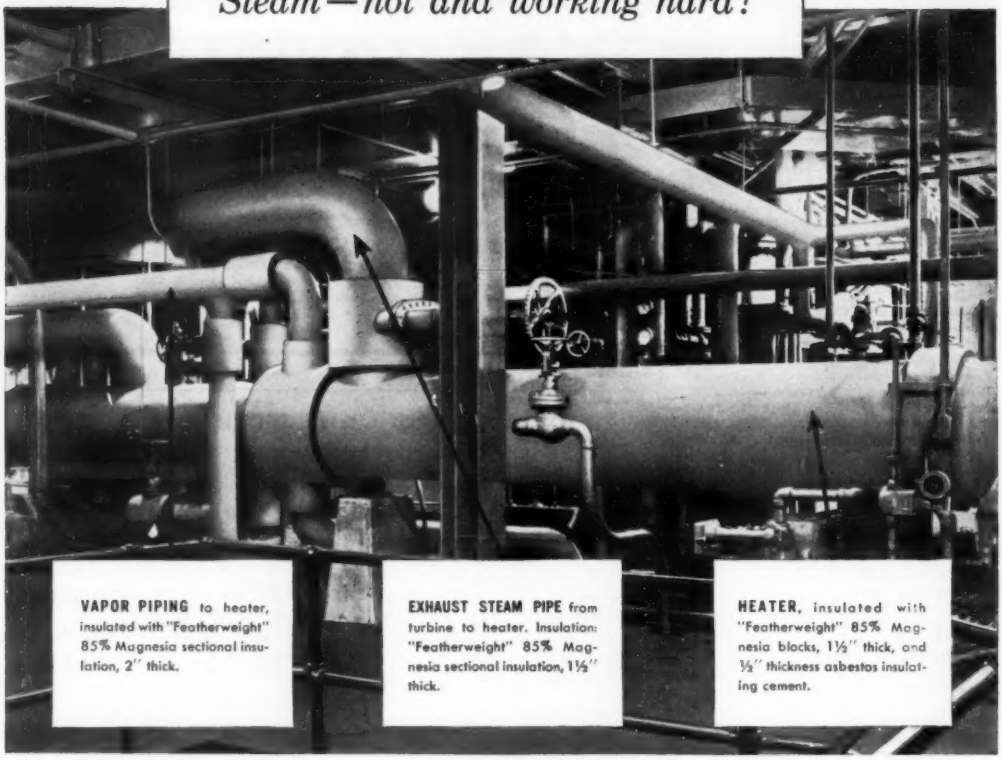
Steam—hot and working hard!



VAPOR PIPING to heater, insulated with "Featherweight" 85% Magnesia sectional insulation, 2" thick.

EXHAUST STEAM PIPE from turbine to heater. Insulation: "Featherweight" 85% Magnesia sectional insulation, 1½" thick.

HEATER, insulated with "Featherweight" 85% Magnesia blocks, 1½" thick, and ½" thickness asbestos insulating cement.

These Keasbey & Mattison Insulations keep heat on the job—keep heating costs down!

Steam is expensive to produce . . . and far too valuable to waste. That's why "Featherweight"® 85% Magnesia was the insulation used in this large Southwestern utility plant.

"Featherweight" 85% Magnesia gives maximum protection against heat loss—keeps steam "on the job" wherever and whenever it's wanted!

This is but one of thousands of installations of "Featherweight" 85% Magnesia Insulation—on ships, in power plants, in the chemical process and food industries. With a background of more than 60 years' service, "Featherweight" is today one of the most widely used and favorably accepted insulations for temperatures up to 600° F. When used in combination with K&M Hy-Temp Insulation, "Featherweight" 85% Magnesia is efficient and practical for temperatures up to 1900° F.

Ask your distributor, who is also an experienced applicator, for complete information on "Featherweight" 85% Magnesia, or any insulations in the complete K&M line. Or, write us.

The newest development in thermal insulation: "KaytherM" High Temperature Blocks

A product of years of research and development! "KaytherM" provides maximum efficiency up to 1500° F. It is molded to size . . . incombustible . . . insoluble in water . . . has exceptional strength and high dimensional stability . . . is light in weight . . . easy to handle . . . quickly applied. Available in flat blocks 6" x 36"; in thicknesses of 1", 1½", and 2".

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COMPANY • AMBLER • PENNSYLVANIA

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

K&M Best in Asbestos®

IN CANADA: ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

Leaving the STRESS where it belongs...

Stress relieving prefabricated piping with highly developed equipment and special techniques is one reason why exacting specifications are met with

GRINNELL PREFABRICATED PIPING

Grinnell received an order recently for stress relieving prefabricated piping to these specifications:—

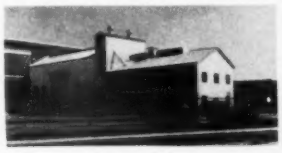
> "All fabricated pieces shall be normalized and drawn by heating to a uniform temperature of 1700°F (plus or minus 25°F). This temperature shall be maintained on a basis of one-half hour for each quarter inch of wall thickness of the heaviest pipe in the furnace charge followed by air cooling not less than 600°F. All pieces shall then be reheated to 1425°F and held at temperatures as above. In no case shall the time be less than 2 hours . . . Cool at a controlled rate not to exceed 200°F per hour until 600°F is reached . . ."

Grinnell, of course, met these specifications precisely. In fact, fabricating industrial piping today demands the *maximum* in versatility and precision.

Modern power plants, for example, need piping of heavy cross-sectional area and definite alloy composition to provide high temperature stability, resistance to creep and graphitization. Chemical and oil refining processes, on the other hand, must have piping of high chrome alloy to impart strength at high temperatures, resist corrosion, withstand impacts at low temperatures. Heat-treating often is the only answer — either to restore properties affected during fabrication, or improve original properties.

GRINNELL'S AUTOMATIC HEAT-TREATING FURNACE

performs with positive efficiency. This versatile stress-relieving unit, measuring 12 by 12 by 40 feet and using gas or oil or both as fuel, was designed to give full program control for the entire range of working temperatures. It provides instrument control of rate of rise in temperature of the charge, length of time for holding at the predetermined temperature level, and cooling rate. Two recording controllers are provided for the furnace and a separate 6-point recorder registers the temperatures of the charge simultaneously during the treating cycle.



Exterior View of Building

In heat-treating, as in everything else for piping, Grinnell has the experience and the costly equipment to fully protect large piping expenditures. That is why it will always pay you to call on Grinnell for *all* of your piping needs.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company Inc., Providence, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

4 Times Hose Life

Ordinary steam hose, used by Grand Central Aircraft Co., Glendale, Calif., in steam-cleaning moth-balled aircraft failed in 6 months because of high pressure and high temperature.

G.T.M. — Goodyear Technical Man — recommended HD Glass Cord Steam Hose reinforced with braided charproof glass fiber. This hose has served over 2 years, 20 hours a day—*four times the service.*

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
-Specified HD GLASS CORD STEAM HOSE
for high temperature-pressure service
A
B
C
A—Heavy-gauge, heat-resistant tube remains soft and flexible at high temperatures.
B—Glass cord "flexible-braided" body is noncharring, handles 200 lbs. psi steam pressure.
C—Tough, sturdy cover provides maximum protection.

FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor. Look for him in the yellow pages of your Telephone Directory.*

GOODYEAR

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